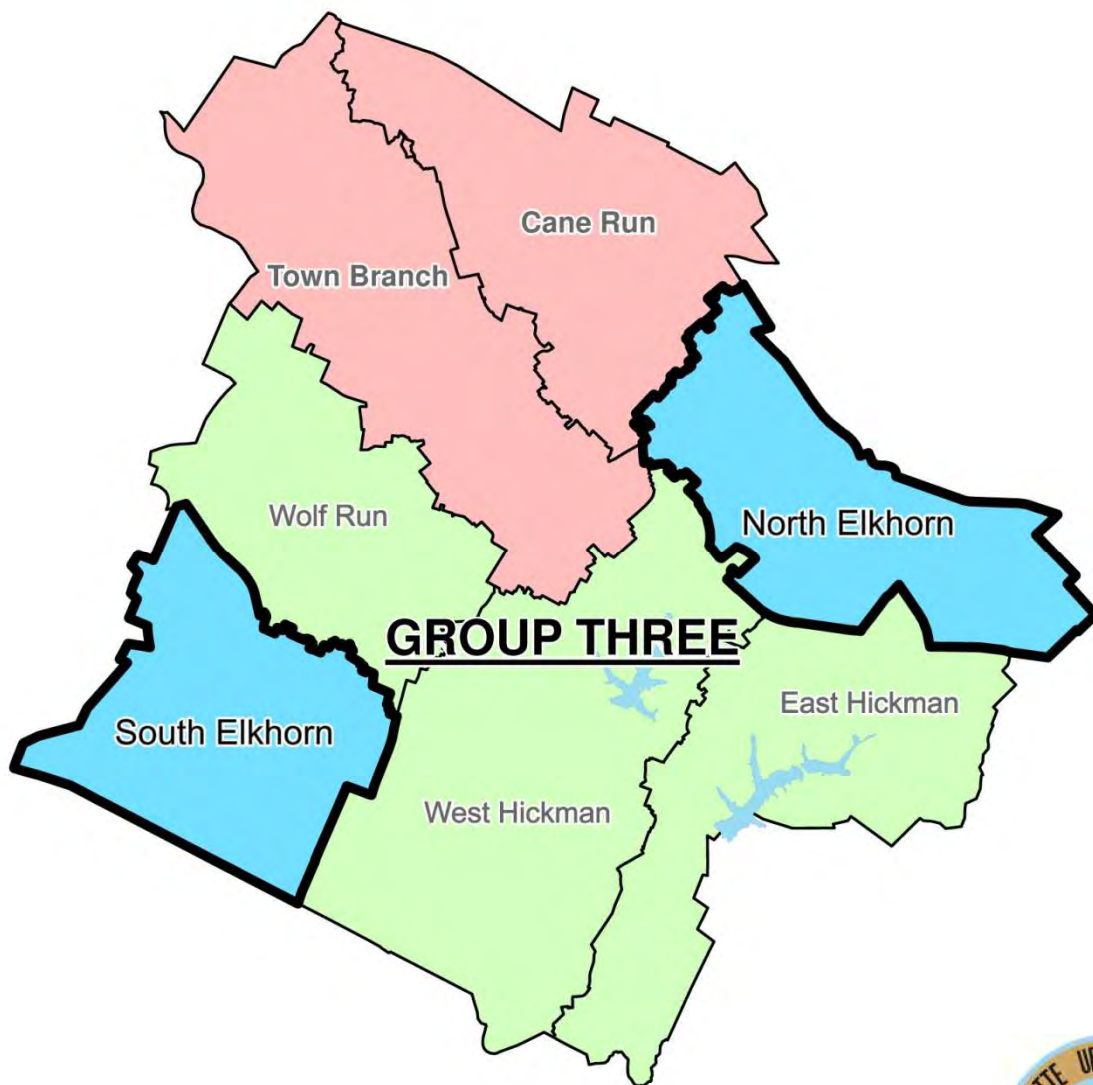


Group Three Sanitary Sewer System and WWTP Remedial Measures Plan

Submittal to the United States Environmental Protection Agency
and the Kentucky Department for Environmental Protection

from
Lexington-Fayette Urban County Government



October 12, 2012





Lexington-Fayette Urban County Government
DEPARTMENT OF ENVIRONMENTAL QUALITY & PUBLIC WORKS

Jim Gray
Mayor

Richard Moloney
Acting Commissioner

October 11, 2012

RE: Civil Action No. 5:06-cv-386
Lexington-Fayette Urban County Government – Kentucky
Group Three Sanitary Sewer System and WWTP Remedial Measures Plan

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
Box 7611 Ben Franklin Station
Washington, D.C. 20044-7611
DOJ No. 90-5-1-1-08858

Chief
Water Programs Enforcement Branch
Environmental Protection Agency Region 4
61 Forsyth Street
Atlanta, Georgia 30303

Dear Sir / Madam:

In accordance with the provisions of Section VII, Paragraph 15.G.(i) of the above referenced document, the Lexington-Fayette Urban County Government (LFUCG) is providing the Group Three Sanitary Sewer System and WWTP Remedial Measures Plan (RMP). This plan is the work product of various professional engineering firms that compiled the required information via independent contracts with LFUCG. The team of Hazen and Sawyer, CDM, and Stantec Consulting Services prepared this report under the direction of LFUCG.

Note that the Implementation Schedule found in Section 5 proposes an implementation schedule measured from the date of EPA/EEC approval of all submitted Remedial Measures Plans. While LFUCG continues to develop and implement its recommended RMP capital projects, LFUCG is also anxious for EPA/EEC official responses regarding the technical approach used in developing the submitted plans. For completion of the work within the CD deadlines, it is essential that LFUCG obtain EPA/EEC approval of the plans within the 60 day timeframe discussed in Paragraph 34 of the CD, since capital commitments are dubious until plan approval is obtained, and all project deadlines are measured/scheduled from that date and are dependent upon the approval.

If you should have any questions, please contact me at (859) 425-2400.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



Signed

10-11-12

Date

Charles H. Martin, P.E., Director
Division of Water Quality
Lexington-Fayette Urban County Government

cc: Director of the Division of Enforcement
Department for Environmental Protection
300 Fairs Oaks Lane
Frankfort, KY 40601

Janet Graham, LFUCG, Commissioner of Law
Richard Moloney, LFUCG, Acting Commissioner of Environmental Quality & Public Works

Enclosure

2 copies – Water Programs Enforcement Branch
1 copy – all other addresses

The following listing is submitted with this report to facilitate the reviewer. The requirements of the Consent Decree Part VII.15.G are included below with a reference to the specific area of the report that fulfills the requirement.

| | Consent Decree Requirement (from VII.15.G Sanitary Sewer System and WWTP Remedial Measures Plan) | Location in RMP Report |
|--|---|-------------------------------|
|--|---|-------------------------------|

| | | |
|-----|--|------------|
| ii | The Sanitary Sewer System and WWTP Remedial Measures Plan (RMP) shall identify all measures necessary to achieve adequate capacity. If insufficient capacity to accommodate projected Peak Flows exists in any portion of the system, identify and propose measures to provide adequate capacity. | Section 3 |
| iii | The RMP shall identify all WWTP upgrades and repair measures necessary to achieve WWTP compliance with all NPDES permit limitations for LFUCG's WWTPs and requirements and to eliminate wet weather Unpermitted Bypasses. | NA |
| iv | The RMP shall identify the degree to which sources of Excessive I/I shall be removed, the degree to which Excessive I/I removal is expected to alleviate capacity constraints, and propose specific remedial measures that will address those capacity limitations not expected to be addressed by Excessive I/I removal. | Section 4 |
| v | The RMP shall identify all measures necessary to eliminate all cross-connections, and Recurring SSOs caused by physical degradation of sewers, inadequate Pumping Stations capacities, or inadequate Pumping Station reliability. | Section 3 |
| vi | <p>The RMP shall, for purposes of developing schedules, prioritize the remedial measures based upon:</p> <ul style="list-style-type: none"> a relative likely human health and environmental impact risks b Recurring SSO frequencies of activations c total annual Recurring SSO volumes <p>LFUCG may also take into account cost-effectiveness and risks associated with implementation. The RMP shall provide a description of the methodology used to apply the above factors</p> | Section 5 |
| vii | The RMP shall provide estimated capital, O&M, and present value costs for each identified remedial measure. The RMP shall provide an expeditious schedule for design, construction, and placement in service of all proposed measures that is in no even later than eleven years from the Effective Date of the CD, or in the event that remedial measures include a WWTP upgrade, thirteen years from the Effective Date of the CD only for such WWTP upgrade and other remedial measures associated with the WWTP upgrade. | Figure 5-5 |

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Appendix 1

Disposition of Group Three Appendix A SSOs Project Data Sheets

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Executive Summary

A. Background

The Sanitary Sewer System and WWTP Remedial Measures Plans (RMPs) are being developed pursuant to Paragraph VII.15.G (Sanitary Sewer System and WWTP Remedial Measures Plan) of the Consent Decree (CD) for the Lexington-Fayette Urban County Government (LFUCG). The CD was lodged on March 14, 2008 and became effective on January 3, 2011. The RMPs are organized according to the major sewersheds within the LFUCG service area as defined in the CD and shown on Figure ES-1:

- Group One: West Hickman, East Hickman, and Wolf Run watersheds (includes the West Hickman WWTP). The Group One RMP was submitted to EPA and Kentucky EPPC on October 14, 2011.
- Group Two: Cane Run and Town Branch watersheds (includes the Town Branch WWTP). The Group Two RMP was submitted to EPA and Kentucky EPPC on April 13, 2012.
- Group Three: North Elkhorn and South Elkhorn watersheds. The Group Three RMP is outlined in this report.

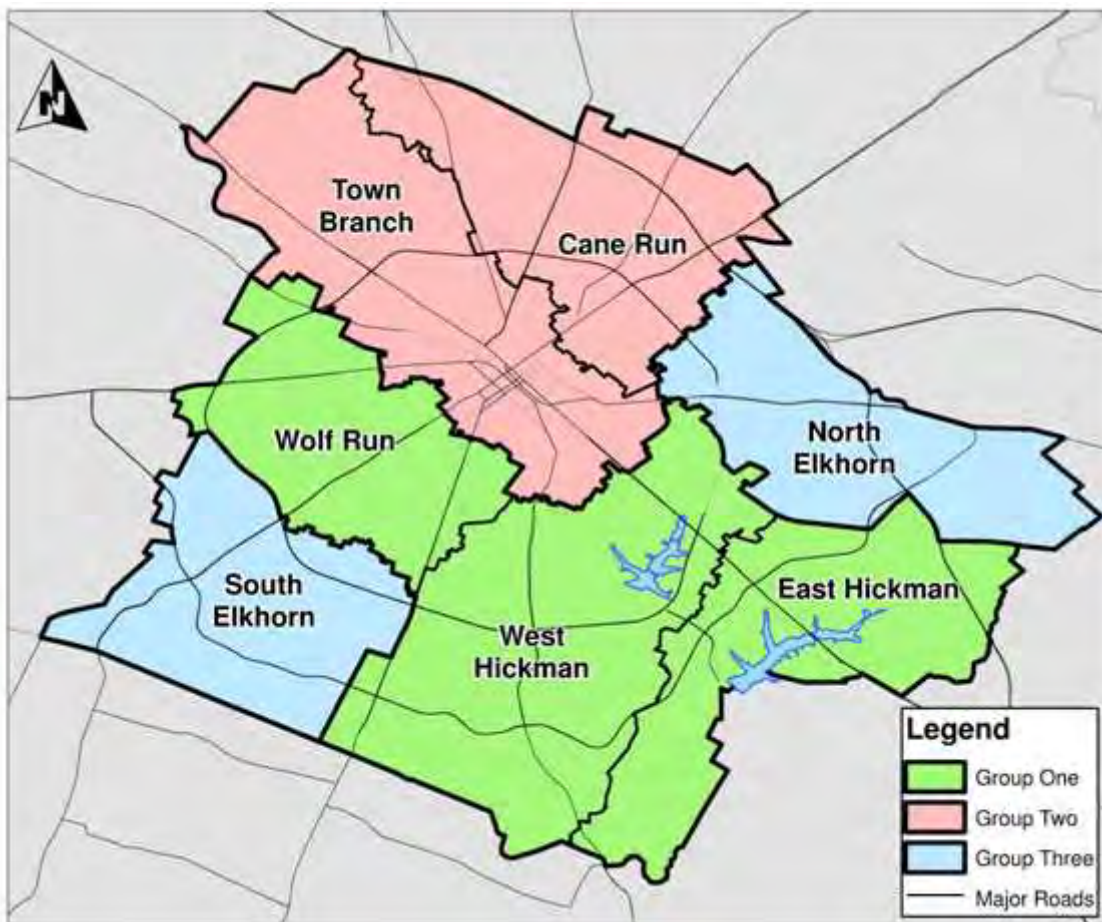


Figure ES-1: Sewershed Groups

The CD requires that LFUCG eliminate recurring sanitary sewer overflows (SSOs) and unpermitted bypasses at the wastewater treatment plant within 11 to 13 years of the effective date of the CD. This Group Three RMP presents the evaluation methodology, solution development process, project development, a prioritized implementation plan, and capital cost estimates.

B. Alternatives and Major Issues

SSOs are caused by capacity restrictions, sewer line blockages, and/or deteriorating sewers. They occur most frequently (but not always) during heavy rainfall events when stormwater enters the sanitary sewer system through pipe defects (infiltration and inflow, or I/I) or illegal private connections and the resulting flow exceeds the capacity of the sewer collection and pumping systems. SSO elimination efforts typically involve increasing system capacity and/or repairing the system to reduce the amount of rainwater entering the sewer system. In the development of this RMP the following “general solutions” were evaluated:

- Increasing system capacity by upsizing pipes, pump stations, and/or the WWTP
- Rehabilitating (repairing) the system, including disconnecting illegal private connections, to reduce I/I such that system capacity is not exceeded
- Providing equalization (EQ) storage for the excess flows during rain events

Analyses of these “toolbox options” were conducted to develop cost-effective solutions for SSO elimination. During the RMP development the following major decisions were made that affected the recommended solutions:

- The Level of Control (LOC), also referred to as the Level of Service, is a critical program decision. This decision sets the performance criteria of the program (i.e. the intensity and duration of storm event for which no capacity-related SSOs would be expected to occur). After much deliberation and public scrutiny, the 2-year, 24-hour storm event was selected for the LOC. Resolution No. 389-2011 passed on September 15, 2011 by the Urban County Council adopted the 2-year, 24-hour storm event as the design storm to form the basis of the LFUCG Sanitary Sewer System and WWTP Remedial Measures Plan. Consideration was also given to developing RMP solutions to eliminate “surcharged conditions” as defined in Paragraph VII.16.B of the Consent Decree for all new facilities and in all areas downstream of likely new development and redevelopment areas. Where solutions were required to eliminate existing/future SSOs, they were designed to avoid system surcharging that would occur for the 2-year, 24-hour storm event.
- LFUCG’s experience with obtaining I/I reduction through rehabilitation and repairs, measured by pre-construction and post-construction flow monitoring, has not been encouraging. While system rehabilitation has been and will continue to be an element of significant investment for LFUCG (currently budgeted at \$5 million per year), it was decided that system rehabilitation would not be an integral part of the RMP solutions. Instead, I/I reduction obtained through system rehabilitation will in effect increase the LOC above the selected 2-year, 24-hour storm event. All proposed system

improvements were designed based on an assumption that there will be no I/I reduction resulting from rehabilitation and other capacity management, operation and maintenance (CMOM) activities.

- Evaluations of LFUCG’s two wastewater treatment plants indicate that they both can treat approximately 70 million gallons per day (MGD) while meeting permitted discharge limits. Their peak capacity listed on their NPDES discharge permits is 64 MGD. For the purpose of the RMP both WWTPs are assumed to have peak capacities of 70 MGD, which will reduce the volume of EQ storage required as compared to limiting the peak capacities to 64 MGD. However, a subsequent WWTP planning process will evaluate potential capacity increases to identify the most cost-effective combination of storage and treatment capacity.
- In general, the number of EQ basins and tanks should be kept to a minimum, as these facilities require cleaning and maintenance and would not be welcomed additions to established residential neighborhoods.
- Sanitary sewer improvements necessary for the development of Expansion Area 2A (in the eastern portion of the North Elkhorn Sewershed) are included in the RMP in accordance with LFUCG’s current 201 Facilities Plan. The Expansion Area 2A improvements will include new trunk sewers to facilitate the elimination of recurring SSOs and four pump stations (Man o’ War, Gleneagles, Blackford, and Greenbrier 1). A 11 MGD pump station will be built to convey all the redirected flow from the pump stations that will be eliminated.

C. Proposed Remedial Measures

Capital construction necessary to eliminate recurring SSOs in the two Group Three sewersheds is shown on Figures ES-2 and ES-3. Table ES-1 summarizes the infrastructure to be constructed and the estimated capital costs of these improvements.

Table ES-1: Proposed Infrastructure and Estimated Capital Costs

| Sewershed | North Elkhorn | South Elkhorn |
|---|----------------|---------------|
| Pipelines – new or replaced | 17,000 LF | 2,000 LF |
| EQ Basin/tank location(s) | 1 | - |
| EQ Basin/tank volume | 2.2 MG | - |
| Total estimated capital costs | \$16.3 Million | \$6.4 Million |
| Total estimated capital costs for Group Three = \$22.7 Million | | |

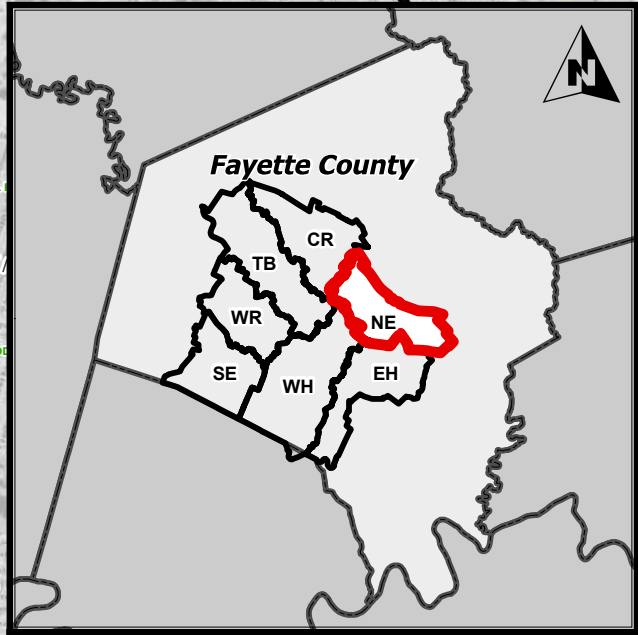
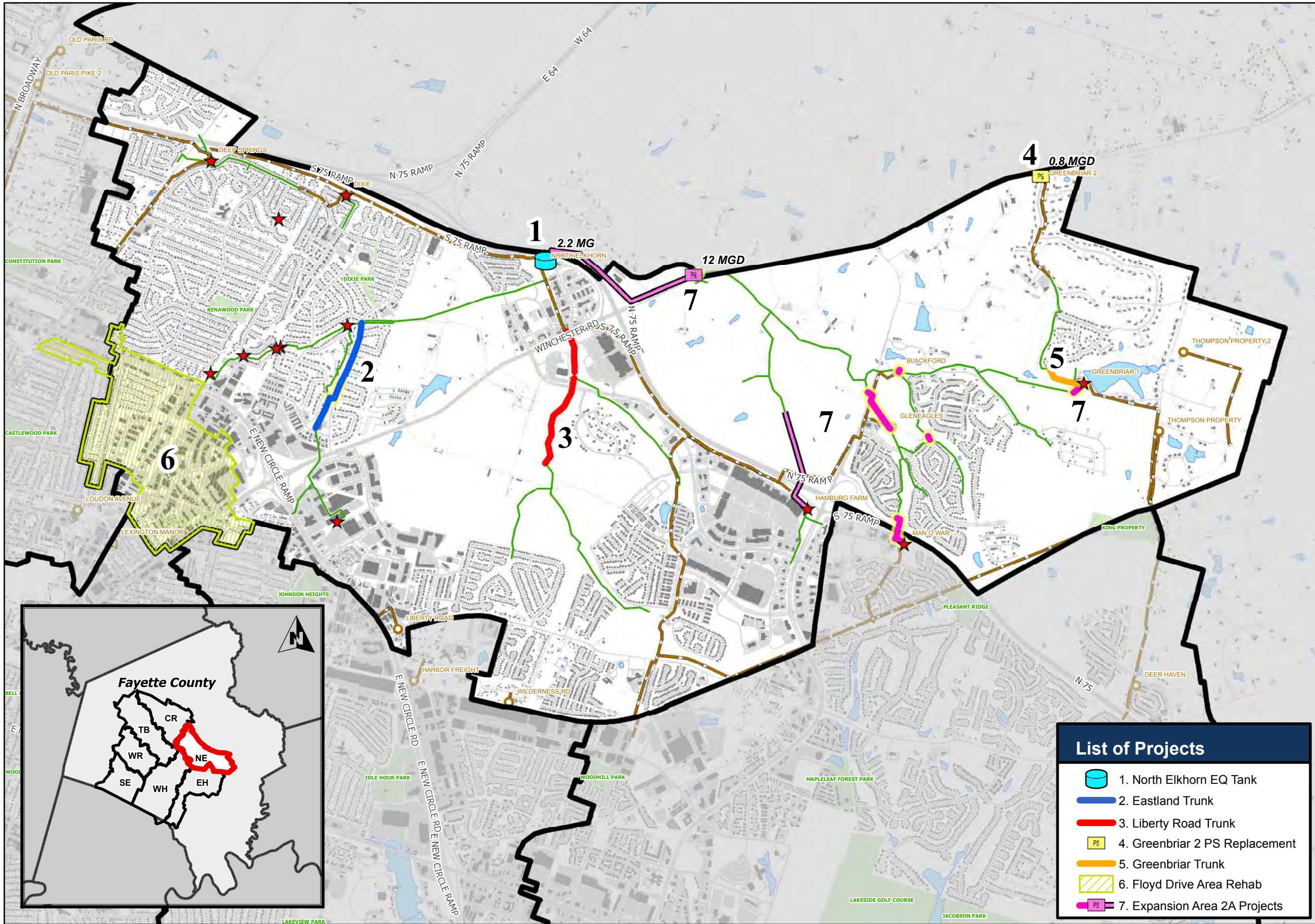
The proposed improvements were divided into discrete projects (see Figures ES-2 and ES-3 for the locations of these projects), and each project was prioritized based on frequency and severity of SSOs and potential health risks to the public. An Implementation Plan was developed based on the priorities, while considering necessary “predecessor” projects. Predecessor projects are

projects that should be completed prior to the subject project. Typically they are downstream of the subject project and are needed to increase capacity so that SSOs are not relocated or new SSOs are not created. The proposed Implementation Plan shows the currently proposed schedule for design and construction of each project and is shown in Figure ES-4 and detailed in Section 5 of this report. The project phasing is also based on anticipated cash flow from LFUCG's financial modeling. The Implementation Plans included in the Group One and Group Two RMPs were considered "tentative" until the completion of the Group Three RMP. The Implementation Plan included in this document includes proposed improvements for all three groups, and LFUCG intends to implement capital improvements in accordance with this plan.

D. Near-term Action Items

This Group Three Sanitary Sewer System and WWTP Remedial Measures Plan is being submitted to the US EPA for review and approval. While EPA is reviewing the document, LFUCG will be proceeding with the following items:

1. Implementing a streamlined process for procurement of engineering and construction services.
2. Implementing a streamlined process for property and easement acquisition.
3. Proceeding with collection system I/I removal and rehabilitation efforts.
4. Initiating certain capital projects within this RMP that are not anticipated to be altered by the regulatory review process.



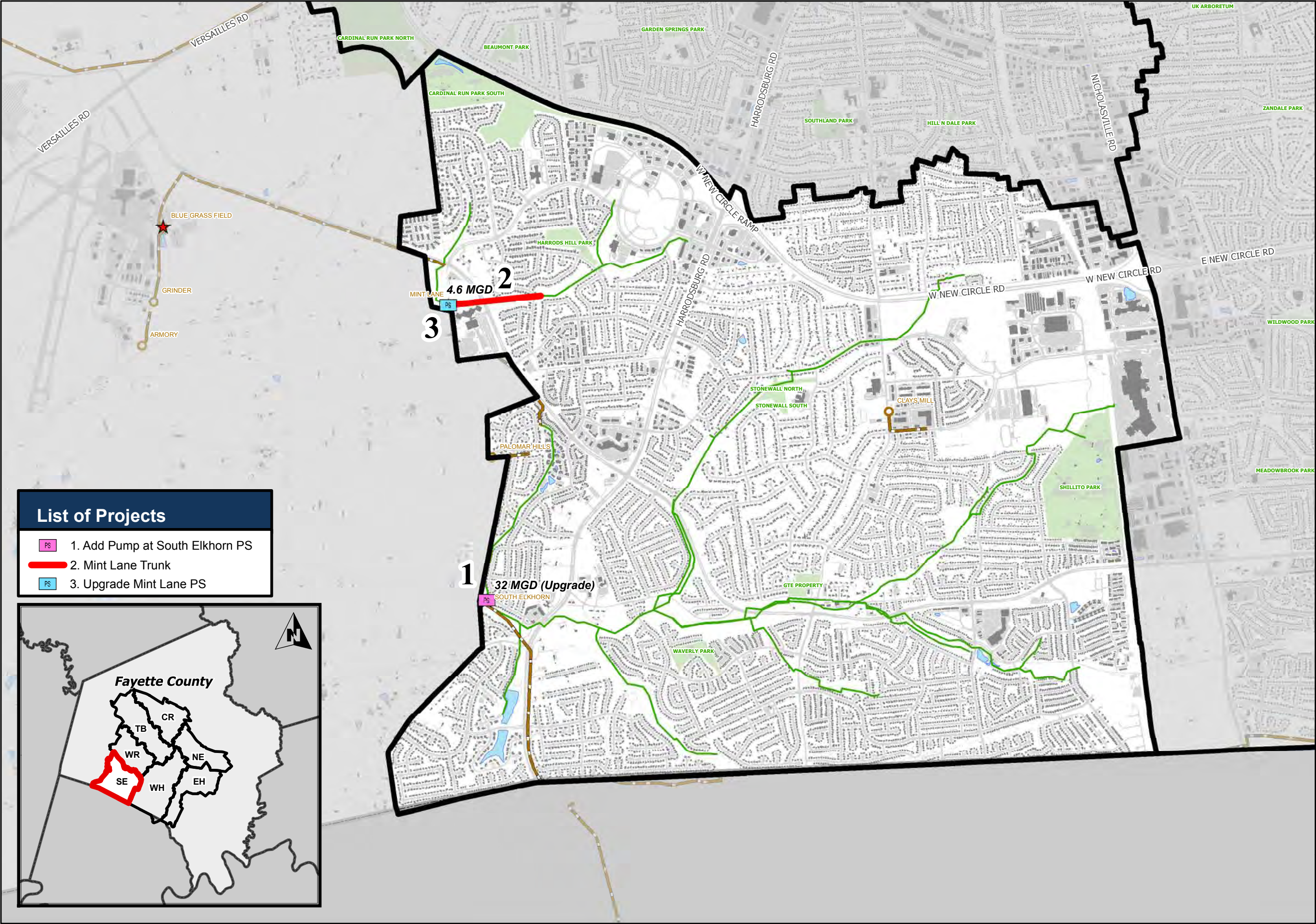
North Elkhorn Solution

| Proposed Remedial Measures (Different Colors Signify Separate "Projects") | | Monitoring List SSO | Appendix A SSO | Existing Pump Station | Existing Trunk Sewer | Existing Force Main | Major Sewershed |
|---|-----------------------|---------------------|----------------|-----------------------|----------------------|---------------------|-----------------|
| Upsize Existing Line | New Pump Station | ★ | ★ | ● | — | — | — |
| New Trunk Sewer | New Equalization Tank | — | — | — | — | — | — |
| New Force Main | — | — | — | — | — | — | — |

- List of Projects
- 1. North Elkhorn EQ Tank
 - 2. Eastland Trunk
 - 3. Liberty Road Trunk
 - 4. Greenbriar 2 PS Replacement
 - 5. Greenbriar Trunk
 - 6. Floyd Drive Area Rehab
 - 7. Expansion Area 2A Projects



1" = 2,400'



List of Projects

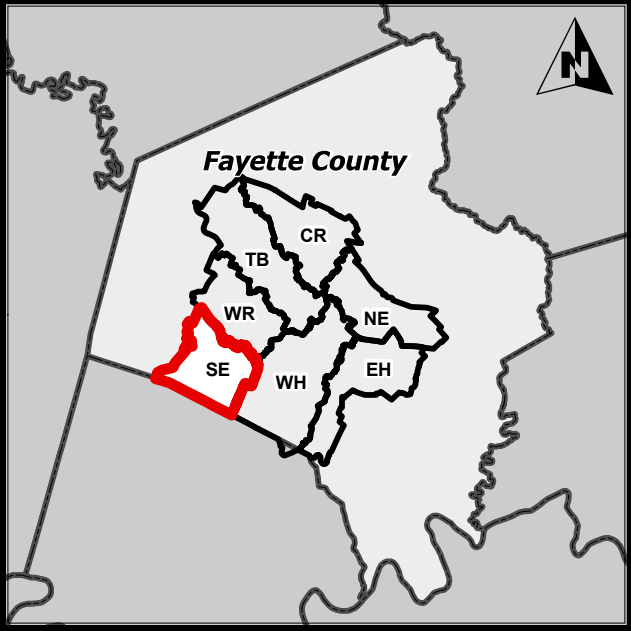
PS

1. Add Pump at South Elkhorn PS

2. Mint Lane Trunk

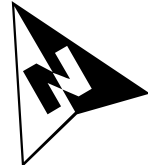
PS

3. Upgrade Mint Lane PS



South Elkhorn Solution

| Proposed Remedial Measures (Different Colors Signify Separate "Projects") | | Monitoring List SSO |
|---|-----------------------------------|------------------------------------|
| <div></div> Upsize Existing Line | <div>PS</div> New Pump Station | <div>★</div> Appendix A SSO |
| <div></div> New Trunk Sewer | <div></div> New Equalization Tank | <div>●</div> Existing Pump Station |
| <div></div> New Force Main | | <div></div> Existing Trunk Sewer |
| | | <div></div> Existing Foremain |
| | | <div></div> Major Sewershed |



1" = 2,400'

RMP Implementation Plan

10/12/2012

All cost estimates are provided in U.S. 2011 dollars.

This implementation schedule is measured from the date of EPA/EEC approval of all submitted Remedial Measures Plans.

| RMP Implementation Plan | | | | | | | | | | | | | | | | | DESIGN | | | |
|---|--|---|-----------------------------------|----------------------------|--------------|--------------|--------------|--------------|-------------|-------------|--------------|--------------|--------------|-------------|--------------|--------------|-------------------------------|----------------------------------|-------------|----------|
| 10/12/2012 All cost estimates are provided in U.S. 2011 dollars. This implementation schedule is measured from the date of EPA/EEC approval of all submitted Remedial Measures Plans. | | | | | | | | | | | | | | | | | CONSTRUCTION | | | |
| Sewer-shed | No. | Project Name | Design Cost Estimate ⁹ | Construction Cost Estimate | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 | Project Capital Cost Estimate | Project Annual O&M Cost Estimate | | |
| East Hickman | 1 | East Hickman FM ¹ | \$860,000 | \$9,210,000 | | | | | | \$860,000 | \$4,605,000 | \$4,605,000 | | | | | \$10,070,000 | \$138,262 | | |
| | 2 | East Hickman PS | \$1,190,000 | \$13,110,000 | | | | | \$595,000 | \$595,000 | \$6,555,000 | \$6,555,000 | | | | | \$14,300,000 | \$345,399 | | |
| | 3 | East Hickman Equalization Tank | \$1,540,000 | \$16,520,000 | | | | | \$770,000 | \$770,000 | \$8,260,000 | \$8,260,000 | | | | | \$18,060,000 | \$248,418 | | |
| | 4 | Overbrook Farm FM ¹ | \$120,000 | \$1,080,000 | | | | | | | | | | | \$120,000 | \$1,080,000 | \$1,200,000 | \$15,865 | | |
| | 5 | Overbrook Farm PS ¹ | \$520,000 | \$5,300,000 | | | | | | | | | | \$520,000 | \$2,650,000 | \$2,650,000 | \$5,820,000 | \$138,676 | | |
| | 6 | Overbrook Farm Trunk ¹ | \$420,000 | \$4,250,000 | | | | | | | | | | | \$420,000 | \$4,250,000 | \$4,670,000 | \$31,686 | | |
| | 7 | Delong Road PS & FM ¹ | \$290,000 | \$2,840,000 | | | | | | | | | | \$290,000 | \$1,420,000 | \$1,420,000 | \$3,130,000 | \$69,927 | | |
| | 8 | Armstrong Mill Trunks ¹ | \$100,000 | \$870,000 | | | | | | | | | | | \$100,000 | \$870,000 | \$970,000 | \$6,379 | | |
| | 9 | Hartland 2 & 3 Trunks ¹ | \$170,000 | \$1,580,000 | | | | | | | | | | | | \$170,000 | \$1,580,000 | \$1,750,000 | \$11,633 | |
| | 10 | Hartland 1 Trunk ¹ | \$120,000 | \$1,020,000 | | | | | | | | | | | | \$120,000 | \$1,020,000 | \$1,140,000 | \$7,458 | |
| | 11 | Eliminate East Lake PS | \$70,000 | \$560,000 | | | | | | \$70,000 | | \$560,000 | | | | | | \$630,000 | \$4,031 | |
| | 12 | Century Hills Trunk Upsize | \$150,000 | \$1,400,000 | | | \$150,000 | \$1,400,000 | | | | | | | | | | \$1,550,000 | \$10,322 | |
| | 13 | East Lake Trunk Upsize | \$80,000 | \$700,000 | | | \$80,000 | \$700,000 | | | | | | | | | | \$780,000 | \$5,110 | |
| | 14 | Autumn Ridge Trunk Upsize | \$100,000 | \$900,000 | | | | | | | | | | | | \$100,000 | \$900,000 | \$1,000,000 | \$6,591 | |
| | 15 | Expansion Area #1 Property Acquisition ¹ | \$1,110,000 | \$- | | | | | | | | | \$1,110,000 | | | | | \$1,110,000 | \$0 | |
| West Hickman | EH Totals = | | \$6,840,000 | \$59,340,000 | \$230,000 | \$2,100,000 | \$0 | \$0 | \$1,365,000 | \$2,295,000 | \$19,420,000 | \$21,090,000 | \$810,000 | \$4,710,000 | \$10,660,000 | \$3,500,000 | \$66,180,000 | \$1,039,757 | | |
| | 1 | WH7 Equalization Tank | \$1,630,000 | \$17,460,000 | | | \$815,000 | \$8,730,000 | \$8,730,000 | | | | | | | | | \$19,090,000 | \$262,554 | |
| | 2 | West Hickman Main Trunk A | \$380,000 | \$3,800,000 | | \$380,000 | \$3,800,000 | | | | | | | | | | | \$4,180,000 | \$28,335 | |
| | 3 | West Hickman Main Trunk B | \$560,000 | \$5,780,000 | | | \$560,000 | \$5,780,000 | | | | | | | | | | \$6,340,000 | \$43,210 | |
| | 4 | West Hickman Main Trunk C | \$440,000 | \$4,400,000 | | | \$440,000 | \$4,400,000 | | | | | | | | | | \$4,840,000 | \$32,845 | |
| | 5 | Landsdowne South Trunk | \$330,000 | \$3,220,000 | | | | | \$330,000 | \$3,220,000 | | | | | | | | \$3,550,000 | \$23,978 | |
| | 6 | West Hickman Main Trunk D | \$370,000 | \$3,660,000 | | | | | \$370,000 | \$3,660,000 | | | | | | | | \$4,030,000 | \$27,295 | |
| | 7 | Merrick Trunk | \$360,000 | \$3,520,000 | | | | | \$360,000 | \$3,520,000 | | | | | | | | \$3,880,000 | \$26,225 | |
| | 8 | Ecton Trunk | \$150,000 | \$1,400,000 | | | | | | \$150,000 | \$1,400,000 | | | | | | | \$1,550,000 | \$10,284 | |
| | 9 | Southeastern Hills Trunk | \$210,000 | \$1,930,000 | | | | | | | | | | | | \$210,000 | \$1,930,000 | \$2,140,000 | \$14,275 | |
| | 10 | West Hickman Main Trunk E | \$750,000 | \$7,950,000 | | | | | | | | \$750,000 | \$7,950,000 | | | | | \$8,700,000 | \$59,659 | |
| | 11 | West Hickman Main Trunk F | \$450,000 | \$4,500,000 | | | | | | | | | \$450,000 | \$4,500,000 | | | | \$4,950,000 | \$33,601 | |
| | 12 | Sutherland Trunk | \$180,000 | \$1,640,000 | | | | | | | | | \$180,000 | \$1,640,000 | | | | \$1,820,000 | \$6,787 | |
| | 13 | Idle Hour Trunk | \$80,000 | \$700,000 | | | | | | | | | \$80,000 | \$700,000 | | | | \$780,000 | \$5,117 | |
| | 14 | Centre Parkway Trunk | \$100,000 | \$850,000 | | | | | | | | | | \$100,000 | \$850,000 | | | \$950,000 | \$6,178 | |
| | 15 | The Island Trunks | \$100,000 | \$890,000 | | | | | | | | | | | | \$100,000 | \$890,000 | \$990,000 | \$8,641 | |
| | 16 | Woodhill Trunk | \$290,000 | \$2,790,000 | | \$290,000 | \$2,790,000 | | | | | | | | | | | \$3,080,000 | \$20,754 | |
| | 17 | Prather Road Trunk | \$200,000 | \$1,870,000 | | | | | | | | | | | | | \$200,000 | \$1,870,000 | \$2,070,000 | \$13,839 |
| | 18 | Richmond Road Trunk | \$170,000 | \$1,530,000 | | | | | | | | \$170,000 | \$1,530,000 | | | | | \$1,700,000 | \$11,271 | |
| | 19 | Wildwood Park Trunk | \$110,000 | \$1,010,000 | | | | | | | | | | | | | | \$1,120,000 | \$7,402 | |
| 20 | WH WWTP Equalization Tank ² | \$10,130,000 | \$108,610,000 | | | | | | | | | | | | | | \$118,740,000 | \$1,423,511 | | |
| WH Totals = | | \$16,990,000 | \$177,510,000 | \$670,000 | \$11,335,000 | \$10,415,000 | \$31,930,000 | \$34,070,000 | \$3,670,000 | \$3,380,000 | \$18,100,000 | \$18,100,000 | \$18,100,000 | \$8,700,000 | \$18,610,000 | \$22,800,000 | \$194,500,000 | \$2,065,759 | | |
| Wolf Run | 1 | Wolf Run Main Trunk A | \$210,000 | \$1,990,000 | | | \$210,000 | \$995,000 | \$995,000 | | | | | | | | | \$2,200,000 | \$14,686 | |
| | 2 | Wolf Run Main Trunk B | \$230,000 | \$2,180,000 | | | | | \$230,000 | \$2,180,000 | | | | | | | | \$2,410,000 | \$16,157 | |
| | 3 | Wolf Run Main Trunk C | \$420,000 | \$4,140,000 | | | | | | \$420,000 | \$2,070,000 | \$2,070,000 | | | | | | \$4,560,000 | \$30,836 | |
| | 4 | Wolf Run Main Trunk D | \$190,000 | \$1,730,000 | | | | | | | | \$190,000 | \$1,730,000 | | | | | \$1,920,000 | \$12,787 | |
| | 5 | Wolf Run Main Trunk E | \$230,000 | \$2,140,000 | | | | | | | | | \$230,000 | \$2,140,000 | | | | \$2,370,000 | \$15,818 | |
| | 6 | Wolf Run Main Trunk F | \$260,000 | \$2,460,000 | | | | | | | | | | \$260,000 | \$2,460,000 | | | \$2,720,000 | \$18,246 | |
| | 7 | Wolf Run Main Trunk G | \$220,000 | \$1,990,000 | | | | | | | | | | | \$220,000 | \$1,990,000 | | \$2,210,000 | \$14,693 | |
| | 8 | Wolf Run Equalization Tank | \$740,000 | \$7,940,000 | | | \$740,000 | \$3,970,000 | \$3,970,000 | | | | | | | | | \$8,680,000 | \$59,675 | |
| | 9 | Parkers Mill Trunk | \$190,000 | \$1,770,000 | | | | | | | | | | | | | \$190,000 | \$1,770,000 | \$1,960,000 | \$13,101 |
| | 10 | Bob O Link Trunk | \$190,000 | \$1,650,000 | | | \$190,000 | \$1,650,000 | | | | | | | | | | \$1,840,000 | \$12,137 | |
| | 11 | Wolf Run Pump Station | \$- | \$9,500,000 | | | \$4,750,000 | \$4,750,000 | | | | | | | | | | \$9,500,000 | \$332,500 | |
| WR Totals = | | \$2,880,000 | \$37,490,000 | \$5,890,000 | \$11,365,000 | \$4,965,000 | \$230,000 | \$2,600,000 | \$2,070,000 | \$2,260,000 | \$1,960,000 | \$2,400,000 | \$2,680,000 | \$2,180,000 | \$1,770,000 | \$40,370,000 | \$540,638 | | | |
| Cane Run | 1 | Lower Cane Run EQ Tank | \$3,120,000 | \$33,440,000 | | | | | | | | | | | | | | \$36,560,000 | \$502,927 | |
| | 2 | Expansion Area 3 PS | \$720,000 | \$6,980,000 | | | | | | | | | | \$8,360,000 | \$8,360,000 | | | \$7,700,000 | \$183,168 | |
| | 3 | Expansion Area 3 FM | \$430,000 | \$3,370,000 | | | | | | | \$720,000 | \$3,490,000 | \$3,490,000 | | | | | \$3,800,000 | \$50,110 | |
| | 4 | Expansion Area 3 Trunk | \$550,000 | \$4,840,000 | | | | | | | | \$220,000 | \$550,000 | \$4,840,000 | | | | \$5,390,000 | \$36,125 | |
| | 5 | Shardon Park Trunks | \$260,000 | \$2,050,000 | | | | | | | | \$260,000 | \$2,050,000 | | | | | \$2,310,000 | \$15,179 | |
| | 6 | Winburn Trunk | \$140,000 | \$980,000 | | | | | | | | | | | | | | \$1,120,000 | \$7,195 | |
| | 7 | Thoroughbred Acres Trunk | \$170,000 | \$1,600,000 | | | | | | | | \$140,000 | \$980,000 | | | | | \$1,120,000 | \$7,195 | |
| | 8 | Sharon Village PS and FM | \$220,000 | \$1,900,000 | | | | | | | | \$170,000 | \$1,600,000 | | | | | \$1,770,000 | \$11,798 | |
| | 9 | Lower Griffin Gate Trunk | \$90,000 | \$770,000 | | | | | | | | | | | | | | \$860,000 | \$5,621 | |
| | 10 | Upper Cane Run EQ Tank | \$500,000 | \$3,980,000 | | | | | | | | | | | \$500,000 | \$3,980,000 | | \$4,480,000 | \$29,701 | |
| | 11 | Cane Run Trunk | \$180,000 | \$1,700,000 | | | | | | | | | | | | | | \$1,880,000 | \$12,530 | |
| | 12 | Lexmark Trunk A | \$160,000 | \$1,480,000 | | | | | | | | | | | | | | | | |

Section 1 Background

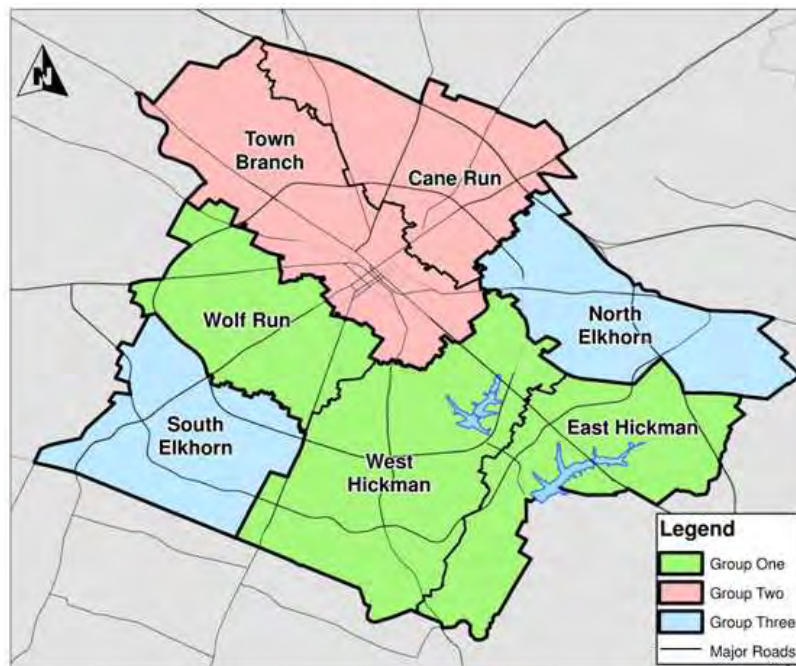
The Group Three Sanitary Sewer System and WWTP Remedial Measures Plan (RMP) consists of specific projects that, when implemented, will result in adequate capacity in the Group Three portions of the sanitary sewer system. Provision of adequate capacity for these facilities will eliminate recurring Sanitary Sewer Overflows (SSOs).

A. Consent Decree

The RMP was developed pursuant to Paragraph VII.15.G (Sanitary Sewer System and WWTP Remedial Measures Plan) of the Consent Decree (CD) for the Lexington-Fayette Urban County Government (LFUCG). The CD was lodged on March 14, 2008 and became effective on January 3, 2011. The RMP is organized according to the major sewersheds within the LFUCG service area as defined in the CD and shown on Figure 1-1:

- Group One: West Hickman, East Hickman, and Wolf Run watersheds (includes the West Hickman WWTP). The Group One RMP was submitted to EPA and Kentucky EPPC on October 14, 2011.
- Group Two: Cane Run and Town Branch watersheds (includes the Town Branch WWTP). The Group Two RMP was submitted to EPA and Kentucky EPPC on April 13, 2012.
- Group Three: North Elkhorn and South Elkhorn watersheds. The Group Three is outlined in this report.

Figure 1-1: Sewershed Groups (includes Future Expansion Areas)



This report summarizes the RMP for the Group Three Sewersheds. It presents the evaluation methodology, solution development process, project development, a prioritized implementation plan and cost estimates.

B. Specific Sanitary Sewer System and WWTP Remedial Measures Plan Requirements

Specific requirements of the CD (Section VII.15.G) related to the RMP are listed below:

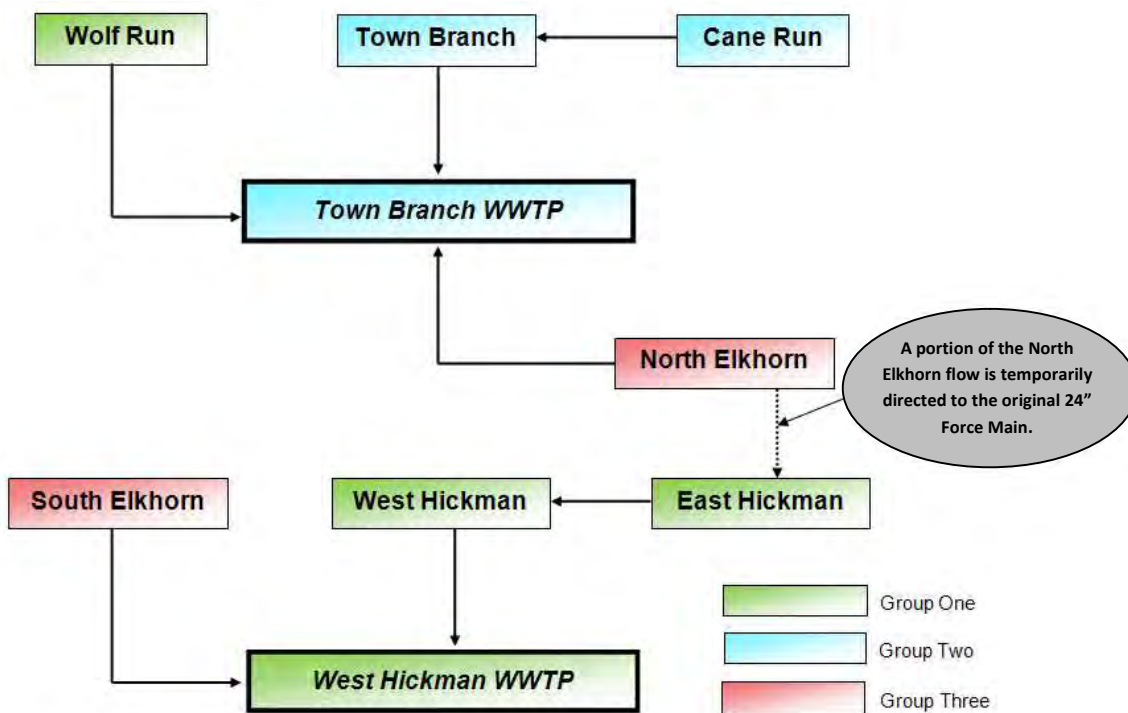
- Specific measures and schedules that will result in adequate capacity such that recurring SSOs, unpermitted WWTP bypasses, and NPDES permit noncompliance are eliminated.
- Peak flows shall include conditions considered in the Sewer System Assessment; identify and propose measures to provide adequate capacity.
- Identify all WWTP upgrades and repairs necessary for permit compliance and wet-weather bypass elimination.
- Identify the degree to which excessive inflow and infiltration (I/I) shall be removed, the degree to which I/I removal will alleviate capacity constraints, and propose remedial measures to address capacity limitations not addressed by I/I removal.
 - a) Anticipated I/I removal rates shall be per industry standards and local experience.
 - b) May include increases in pump station (PS) and sewer capacity, equalization (EQ) basins, or WWTP capacity increases.
- Eliminate all cross connections and recurring SSOs resulting from physical degradation of sewers, inadequate PS capacity, or inadequate PS reliability.
- Prioritize the remedial measures based on the following and include a description of prioritization methodology related to these factors:
 - a) Human health and environmental impacts
 - b) SSO frequency
 - c) SSO volume
 - d) Cost-effectiveness and “risks associated with implementation”
- Provide estimated capital, O&M, and present value costs for each remedial measure using year-specific dollars.
- Provide an expeditious schedule for design, construction, and placement in service.
 - a) No later than 11 years from effective date of the CD, except that the upgrades can extend to 13 years if WWTP work is to be done.
 - b) Include milestone dates for each project: preliminary design, final design, permitting, contract award, begin construction, and end construction.
- There shall be no restrictions on LFUCG implementing interim remedial measures prior to RMP approval.

The SSOs that are discussed and addressed as part of this RMP are the 111 SSOs listed in Appendix A of the CD. Within those, there are 9 cross connections, 7 basement backups, and 12 maintenance-related SSOs. The remaining 83 SSOs are at manholes and pump stations and will be eliminated by the implementation of remedial measures implemented over the next 11 to 13 years. The explicit removal of cross connections is another objective of all three RMPs. The

basement backups will be addressed by a combination of increased system capacity, long-term I/I reduction, and the installation of backtrap valves.

A schematic of the flow paths comprising the LFUCG Sewersheds is provided in Figure 1-2. The flow paths have recently undergone major changes. One major change includes the redirection of most of the North Elkhorn Pump Station effluent from the East Hickman gravity sewer system to a direct discharge at the Town Branch WWTP. Another change is the redirection of flow from South Elkhorn Pump Station from the West Hickman gravity sewer system to a direct discharge at the West Hickman WWTP. These flow redirections provided significant additional capacity in the portions of the gravity sewer system that had previously received the pump station discharges.

Figure 1-2: Existing Sewershed Flow Routing



C. Related Studies

The following related reports were prepared in accordance with the requirements of the Consent Decree and were submitted for review by EPA and the DOW:

- *Sanitary Sewer Assessment Work Plan (June 2008)* – Documents the procedures and schedule for completing a condition assessment and performance evaluation of the Sanitary Sewer System.
- *Hydraulic Model Report (July 2008)* – Documents the selection of the hydrologic and hydraulic model of the wastewater collection system. This model was used to complete a capacity assessment and to develop all proposed remedial measures.

- *Capacity Assessment Work Plan (September 2008)* – Documents the assumptions, tools and protocols to be used to determine the hydraulic capacities of the Sanitary Sewer System, and to compare these capacities to flow conditions resulting from existing and projected future flows under dry and wet-weather conditions.
- *Group One Sewer System Assessment Report (April 2011)* – Documents the results of the sanitary sewer assessment field investigations and capacity assessment of the Group One Sewersheds. This report includes documentation of the sanitary sewer field activities and results, pumping station design, capacity, and equipment adequacy evaluation, hydraulic model development, the estimation of future flows, hydrologic and hydraulic calibration, capacity assessment results, and improvements completed during the SSA studies.
- *Group One Remedial Measures Plan (October 2011)* – Describes the methodology and results of a master plan to eliminate recurring SSOs in the Group One sewersheds. This plan included a draft Implementation Plan for conveyance and storage facilities that will be updated and revised as plans for the other two groups are completed.
- *Group Two Sewer System Assessment Report (October 2011)* – Documents the results of the sanitary sewer assessment field investigations and capacity assessment of the Group Two Sewersheds with a methodology and presentation similar to the Group One SSA Report. The Group Two hydraulic models continued to be improved during the course of developing this RMP, as described in Section 2.
- *Group Two Remedial Measures Plan (April 2012)* – Describes the methodology and results of a master plan to eliminate recurring SSOs in the Group Two sewersheds. This plan included a draft Implementation Plan for conveyance and storage facilities that will be updated and revised as plans for Group Three are completed.
- *Group Three Sewer System Assessment Report (April 2012)* – Documents the results of the sanitary sewer assessment field investigations and capacity assessment of the Group Three Sewersheds with a methodology and presentation similar to the Group Two SSA Report. The Group Three hydraulic models continued to be improved during the course of developing this RMP, as described in Section 2.
- *Sanitary Sewer Pump Station Operation Plan for Power Outages Report (September 2012)* – Documents the results of investigations completed for each of LFUCG's 82 pump stations, with respect to emergency power and emergency pumping capabilities. Recommendations were made to improve pump station reliability and emergency response to power and pump failures.

D. Projects Completed to Date or In-Progress

LFUCG has initiated several capacity enhancement projects and activities in advance of initiating this RMP. These projects are described in Section 7 of the Group Three Sewer System Assessment Report (April 2012). Major capital projects are summarized below:

1) Status of Projects from CD Paragraph VII.15.A

The following projects were stipulated in the Consent Decree with defined completion dates.

a) North Elkhorn Force Main Diversion

At the time of lodging, the flow from the North Elkhorn Pump Station discharged to gravity sewers in the East Hickman sewershed. To restore hydraulic capacity at the East Hickman Pump Station and allow for a capacity upgrade at the North Elkhorn Pump Station, the majority of the North Elkhorn Pump Station flow was diverted to the Town Branch WWTP. Minimal flow has been maintained in the existing 24-inch force main to maintain hydraulic integrity of other discharges into the 24-inch force main. This project included upgrading the pump station to a design capacity of 19MGD and the installation of approximately 7 miles of new 30- and 36-inch force main.

The North Elkhorn Pump Station currently pumps approximately 75% of its total flow through the newly constructed force main to the Town Branch WWTP. The remaining 25% of the flow is pumped through the pre-existing 24-inch force main to the East Hickman sewershed. Force mains from other pump stations manifold into this pre-existing 24" force main and the portion of flow from the North Elkhorn Pump Station is required to maintain hydraulic integrity. This force main will remain in service at least temporarily and used to aid in distribution of flows to reduce overflow risk in the system.

This project was required to be completed within 24 months from lodging date of the Consent Decree; the deadline was therefore March 14, 2010. The pump station was upgraded first and put into service prior to the force main installation. With a completion date of October 2009, this project was finished within the directed timeframe.

b) South Elkhorn Pump Station and Force Main

Due to high rates of infiltration and inflow in the contributing sewershed, the South Elkhorn Pump Station has had a very high incidence of SSOs. In order to eliminate this recurring SSO, the pump station and its associated force main were upgraded to a new capacity of 29 MGD and is scheduled to increase to a capacity of 32 MGD as part of Group Three RMP. This expansion included the installation of a new wet well, five pumps, and seven miles of 36-inch force main to transport flow directly to the West Hickman WWTP.

This project was required to be completed within 30 months from lodging date of the Consent Decree; the deadline was therefore September 14, 2010. With a completion date of September 2010, this project was finished within the directed timeframe.

c) Deep Springs Pump Station

The Deep Springs Pump Station was to be replaced with a new pump station that will have an increased capacity. The force main would also be upgraded to manifold into the new North Elkhorn force main.

This project was required to be complete within 30 months of the completion date of the North Elkhorn Force Main Diversion Project, which would be April 2012, but no later than 54 months from the lodging date of the Consent Decree, (September 14, 2012); the deadline is therefore April 2012. This project was put into service in March 2012, within the directed timeframe.

d) Dixie Pump Station

The Dixie Pump Station was upgraded to include an increase in the firm pumping capacity. The force main was also upgraded to manifold into the new North Elkhorn force main.

This project was required to be complete within 30 months within the completion date of the North Elkhorn Force Main Diversion Project, which would be April 2012, but no later than 54 months from the lodging date of the Consent Decree, which would be September 14, 2012; the deadline is therefore April 2012. This project was completed and placed into service February 3, 2012, within the directed timeframe.

2) Early Capital Improvement Projects to Address Recurring SSOs

The following projects were not specifically identified in the Consent Decree, but have been initiated by LFUCG prior to RMP submission to address recurring SSOs.

a) Wolf Run Pump Station

The Wolf Run Pump Station has an estimated capacity of less than 10 MGD based on drawdown testing from September 2008 and is a recurring SSO. This pump station will be relocated downstream and the capacity increased to 20 MGD. A new force main that discharges to the Town Branch WWTP is included in this work. The design for this project is complete and the pump station contract has been awarded. Construction is expected to commence in the near future, pending easement and permit acquisition.

b) Expansion Area 2A Pump Station

The Expansion Area 2A Pump Station has been designed to eliminate four smaller pump stations in the North Elkhorn sewershed and to provide expansion capacity to a developing section of the service area. The four pump stations being eliminated are: Man o' War,

Blackford, Greenbriar #1, and Gleneagles. The Man o' War and Greenbriar #1 pump stations are listed as recurring SSOs. The flow to these existing pump stations will flow by gravity to the new Expansion Area 2A Pump Station, which is planned to have a design capacity of 11 MGD. The design of this project is complete and the contract for construction of the pump station has been awarded. Contract award for the construction of the force main and gravity lines to eliminate existing pump stations is anticipated fall 2012.

c) Bluegrass Airport Pump Station (Complete)

The Bluegrass Airport Pump Station was a recurring SSO due to a combination of inadequate wet weather capacity and electrical/mechanical failures. This pump station had a design operating condition of 0.3 MGD(192 gpm); however, drawdown testing showed that the pumps were producing a flow of approximately 0.1 MGD (95 gpm). Although this pump station only runs infrequently, it receives runway runoff during de-icing operations (high glycol concentration events) and requires a higher flow capacity. The upgrades to the system included the addition of a wetwell, two new pumps rated for 0.6 MGD (429 gpm), a new valve vault, a new generator for back-up power, and a new 6" force main (approximately 9000 linear feet). This project has been completed and placed in service.

3) Other Capital Improvement Projects

The following project was not specifically identified in the Consent Decree, but has been completed by LFUCG to address operation and maintenance issues. The project does not specifically address a recurring SSO, but was considered when developing/sizing RMP solutions.

a) Griffin Gate Pump Station (Complete)

The Griffin Gate Pump Station had a design operating condition of 0.21 MGD (150 gpm) and LFUCG staff noted that the pumps were unreliable and experienced extreme short cycling. The pumps and wet wells have been replaced and the new rated capacity is 0.27 MGD (188 gpm). This project was completed in June 2011.

E. Definitions and Acronyms

In order to provide a clear understanding of terms used, some of the more common and significant definitions and acronyms are provided. They are organized into terms that are defined in the CD where applicable.

1) Definitions included in the Consent Decree

The following definitions and acronyms are included in the CD (Introduction) and are relevant to capacity assessment activities:

"Building Backup" shall mean a subcategory of SSOs which occurs when a wastewater backup occurs into a building and is caused by blockages, malfunctions, or flow conditions in the

Sanitary Sewer System. A wastewater backup that is caused by a blockage or other malfunction of a Private Lateral is not a Building Backup.

“Capacity, Management, Operations, and Maintenance” or “CMOM” shall mean, for the purpose of the Consent Decree only, a structured program of accepted industry practices to properly manage, operate and maintain sanitary wastewater collection, transmission and treatment systems, investigate capacity-constrained areas of these systems, and respond to SSO events.

“Consent Decree” or “Decree” shall mean the United States of America and the Commonwealth of Kentucky v. Lexington-Fayette, Civil Action No. 5:06-cv-386 and all its attachments.

“Day” (whether or not capitalized) shall mean a calendar day unless expressly stated to be a working day. In computing due dates under the Consent Decree, where the last day would fall on a Saturday, Sunday, or federal holiday, the period shall run until the close of business of the next working day.

“EPA” shall mean the United States Environmental Protection Agency and any successor departments or agencies of the United States.

“EPPC” shall mean the Environmental and Public Protection Cabinet of the Commonwealth of Kentucky. (Note: the EPPC has been replaced by the Energy & Environment Cabinet or EEC).

“Excessive Inflow/Infiltration” or “Excessive I/I” shall mean the Inflow/Infiltration (I/I) that LFUCG determines can be cost-effectively eliminated as determined by a cost-effectiveness analysis that compares the costs of eliminating the I/I with the total costs for transportation and treatment of the I/I (including capital costs of increasing transmission and treatment capacity, and resulting operating costs).

“Force Main” (FM) shall mean all sanitary sewer lines that operate under pressure due to pumping of sanitary wastewater at a pump station except for those sanitary sewer lines that serve a single structure or building.

“Gravity Sewer Line” shall mean a pipe that receives, contains and conveys wastewater not normally under pressure, but is intended to flow unassisted under the influence of gravity. Gravity sewers are typically not intended to flow full under normal operating conditions.

“I/I” shall mean the total quantity of water from Infiltration and Inflow without distinguishing the source.

“Infiltration” as defined by 40 C.F.R. § 35.2005(b)(20) shall mean water other than wastewater that enters a sanitary sewer system (including sewer service connections and foundation drains) from the ground through such means as defective pipes, pipe joints, connections, or manholes.

“Inflow” as defined by 40 C.F.R. § 35.2005(b)(21) shall mean water other than wastewater that enters a sanitary sewer system (including sewer service connections) from sources such as, but

not limited to, roof leaders, cellar drains, yard drains, area drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm water, surface runoff, street wash waters, or drainage.

“LFUCG” shall mean the Lexington-Fayette Urban County Government, a municipality within the meaning of that term in CWA, established under the laws of the Commonwealth of Kentucky.

“LFUCG’s WWTPs” shall mean West Hickman Creek WWTP and the Town Branch WWTP.

“Major Gravity Line” shall mean any of the following: all Gravity Sewer Lines that are twelve inches in diameter or larger; all eight inch Gravity Sewer Lines that are necessary to accurately represent flow attributable to a service area in each of the sewersheds; all Gravity Sewer Lines that convey wastewater from one Pumping Station service area to another pumping station service area; and all Gravity Sewer Lines that substantially contribute, or that LFUCG knows will likely substantially contribute, to recurring SSOs.

“One Hour Peak Flow” as that term is used in Paragraph 16.B of the CD for the CMOM Capacity Assurance Program only, shall mean the greatest flow in a sewer averaged over a sixty (60) minute period at a specific location expected to occur as a result of a representative 2-year 24-hour storm event.

“Paragraph” shall mean a portion of the Consent Decree identified by an Arabic numeral.

“Parties” shall mean the parties to this Consent Decree: the United States, the Commonwealth, and LFUCG.

“Peak Flow” as that term is used in Subparagraphs 15.D – 15.G of the CD, shall be determined based upon sound engineering judgment and commonly accepted design practice.

“Private Lateral” shall mean that portion of a sanitary sewer conveyance pipe, including that portion in the public right of way, that extends from the wastewater main to the single-family, multi-family, apartment, other dwelling unit, business, industry, institution or structure to which wastewater service is or has been provided. Private Laterals do not include connector joints at LFUCG’s sewer line.

“Pumping Station” (PS) shall mean all pumping stations owned or operated by LFUCG except for pump stations that serve a single structure or building, and except for the pump station serving Southland Christian Church in Jessamine County.

“Recurring SSO” shall mean, for the purpose of the Consent Decree only, an SSO that occurs in the same location more than once per twelve (12) month rolling period.

“Reporting Year” shall mean each annual period commencing at the start of LFUCG’s fiscal year on July 1 of each year.

“Reporting Year Covered by the Consent Decree.” A Reporting Year is covered by this Consent Decree if any part of the Reporting Year falls after the Effective Date of, and before the termination of this Decree.

“Sanitary Sewer Overflow” or “SSO” shall mean, for the purpose of the Consent Decree only, any discharge to waters of the United States from the Sanitary Sewer System through point sources not specified in any KPDES permit (otherwise known as “unpermitted Discharges”), as well as any release of wastewater from the Sanitary Sewer System to public or private property that does not reach waters of the United States, such as a release to a land surface or structure that does not reach waters of the United States; provided, however, that releases or wastewater backups into buildings that are caused by blockages, flow conditions, or malfunctions in a Private Lateral, or other piping or conveyance system that is not owned or operationally controlled by LFUCG are not SSOs. SSOs include any cross-connections between LFUCG’s Sewer System and its MS4 which allow wastewater to pass from the Sanitary Sewer System to the MS4, but do not include exfiltration that does not reach waters of the United States, or land surface or structures.

“Sanitary Sewer System” shall mean the wastewater collection and transmission systems (WCTS) owned or operated by LFUCG designed to collect and convey municipal sewage (domestic, commercial and industrial) to a WWTP. The Sanitary Sewer System does not include LFUCG’s MS4.

“Section” shall mean a portion of the Consent Decree identified by a Roman numeral.

“Sewershed” shall mean a section of LFUCG’s WCTS that is a distinct drainage or wastewater collection area and designated as such by LFUCG. For purposes of this Consent Decree, the sewersheds have been grouped as follows: Group One consists of West Hickman, East Hickman, and Wolf Run Sewersheds; Group Two consists of Cane Run and Town Branch Sewersheds; and Group Three consists of North Elkhorn and South Elkhorn Sewersheds.

“Ten States Standards” shall mean the applicable edition, incorporated by reference by Kentucky Regulation 401 KAR 5:005 § 29, of the “Recommended Standards for Wastewater Facilities: Policies for the Design, Review, and Approval of Plans and Specifications for Wastewater Collection and Treatment Facilities, Wastewater Committee of the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.”

“Town Branch WWTP” shall mean the wastewater treatment plant located at 301 Lisle Industrial Avenue, Lexington, Kentucky, owned and operated by LFUCG, which discharges to Town Branch Creek from outfall 001 and pursuant to KPDES Permit No. KY0021491.

“Unpermitted Bypass” shall mean any discharge to the waters of the United States from any of LFUCG’s WWTPs which constitutes a prohibited bypass as defined in 40 C.F.R. § 122.41(m), and 401 KAR 5:065 Section 1(13).

“Wastewater Collection and Transmission Systems” or “WCTS” shall mean the municipal sanitary wastewater collection and transmission systems, including all pipes, force mains,

gravity sewer lines, lift stations, pumping stations, manholes and appurtenance thereto, which are owned or operated by LFUCG.

“WWTP” shall mean wastewater treatment plant.

“West Hickman Creek WWTP” shall mean the wastewater treatment plant located at 645 West Hickman Plant Road/Ash Grove Pike, Nicholasville, Jessamine County, Kentucky, owned and operated by LFUCG, which discharges to West Hickman Creek from outfall 001 and pursuant to KPDES Permit No. KY0021504.

2) Additional Definitions and Acronyms

The following additional definitions and acronyms are used in this report:

“Average Daily Flow” (ADF) shall mean the total flow over a given period, divided by the number of days in the period.

“BWWF” or “Base Wastewater Flow” is domestic (or sanitary) wastewater from residential, commercial, institutional (schools, churches, hospitals, etc.) sources, and industrial wastewater sources.

“CAP” shall mean Capacity Assurance Program.

“CAWP” shall mean Capacity Assessment Work Plan.

“gpcd” means gallons per capita per day and refers to wastewater generation rate per person.

“GWI” means Groundwater Infiltration which is defined as the groundwater entering the collection system through defective pipes, pipe joints, and manhole walls.

“HMR” shall mean Hydraulic Model Report

“RDI/I” means rainfall-dependent infiltration/inflow.

“RMP” means Sanitary Sewer System and WWTP Remedial Measures Plan(s).

“SSAWP” shall mean the Sanitary Sewer Assessment Work Plan.

“TBWWTP” shall mean Town Branch Wastewater Treatment Plant.

“WHWWTP” shall mean West Hickman Wastewater Treatment Plant.

Section 2 Methodology

A. Modeling

The hydraulic models utilized for the development of the Group Three Sanitary Sewer System and WWTP Remedial Measures Plan (RMP) were developed and calibrated as part of the Capacity Assessment. Future growth conditions were assumed in the model when evaluating RMP project alternatives. A detailed summary of model assumptions, methodology, and results was documented in the Sanitary Sewer Hydraulic Modeling Report (HMR), dated July 2008, and the Group Three Sanitary Sewer Assessment Report (SSA Report), submitted in April 2012. The following subsections summarize refinements to the model since submission of the Group Two Capacity Assessment Report. Additionally, a summary of key assumptions with respect to development of future condition sewer flows is also provided.

1) Model Recalibration

a) *2010 Flow Monitoring*

Calibration of the hydraulic models used for the Group Three Capacity Assessment were based on flow monitoring in the sewer system performed in the spring of 2009. A total of 40 flow meters and 10 rain gages were utilized in the Group Three sewersheds during the 2009 flow monitoring period.

Subsequent flow monitoring was performed in the Group Three sewersheds in the spring of 2010. The 2010 flow monitoring included a total of 49 flow meters and 11 rain gages located within the Group Three sewersheds and coincided with the flow monitoring period for Group Two. The 2010 flow monitoring was performed to further isolate inflow and infiltration (I/I) within the collection system and guide prioritization of SSA field investigation activities. Flow data collected during the 2010 monitoring period was provided in the Group Three SSA Report, dated April 12, 2012.

b) *Sewer System Improvements*

LFUCG has completed several early SSO reduction projects since the publication of the Capacity Assessment Report and hydraulic model development. These projects include the replacement of the South Elkhorn Pump Station and Force Main and construction of the North Elkhorn Pump Station and Force Main Diversion. Construction of the North Elkhorn Pump Station and Force Main Diversion redirected a large portion of the discharge from the North Elkhorn pump station from the East Hickman sewershed (and ultimately the West Hickman WWTP) to the Town Branch WWTP. Other completed early SSO reduction projects include the replacements of Deep Springs Pump Station and Dixie Pump Station which both have force mains that manifold into the new North Elkhorn Force Main, and the Bluegrass Field Pump Station replacement and force main diversion which redirected flow at the Bluegrass Airport from the Wolf Run sewershed to the Mint Lane Pump Station in the South Elkhorn sewershed.

c) *Supplemental Surveying*

Supplemental surveying was performed in areas where model calibration was poor. Pipe inverts and sizes were field surveyed and compared with those in the hydraulic model. Additionally, in areas of where manhole inspections and closed circuit television (CCTV) inspection had been performed, collected data was similarly used to verify sewer dimensions and grades in the hydraulic model.

d) *Updated Land Use*

Future land use conditions were further refined since publication of the Capacity Assessment Report, based on discussions with LFUCG Division of Planning staff and was coordinated with the 2007 Lexington-Fayette County Comprehensive Plan. New pump stations and sewers were added and sized to accommodate the needs of the Urban Service Area expansion. The model was updated to reflect these changes during the development of the Remedial Measures.

e) *Revised Capacity Assessment Results*

The hydraulic model was refined and recalibrated based on 2010 flow data, physical changes presented by the capital projects mentioned in Section A.1(b) above, and updated land use information. The 2010 flow monitoring season was one of the wettest springs on record in Lexington and recalibration of the hydraulic model resulted in an increased overall wet weather response predicted in the sanitary sewer system.

Figures 2-1 and 2-2 summarize system surcharging and SSO locations in the Group Three sewersheds as well as the rest of the system predicted by the recalibrated models for the future year (2035) condition. Model results indicate that approximately 30 percent of the modeled trunk sewers in the North Elkhorn sewershed would experience overflows or surcharging for the future population (2035), 2-year, 24-hour storm event. In the South Elkhorn sewershed, approximately 10 percent of modeled trunk sewers would experience overflows or surcharging for the future population (2035), 2-year, 24-hour storm event.

The recalibrated models and results presented in Figures 2-1 and 2-2 were used as the baseline for evaluating RMP solutions.

2) Modeled Sewer Flows (Future Conditions)

The hydraulic capacity of the sanitary sewer system was evaluated under existing and projected future conditions. The methodology for developing sewer flows for future conditions was summarized in the Group One Sanitary Sewer System and WWTP Remedial Measures Plan (October 2011), the Capacity Assessment Report, and in the Hydraulic Modeling Report (July 2008). This same methodology was adopted in the Group Three sewersheds. A brief summary of the key assumptions follows.

- Future conditions were defined as the year 2035.

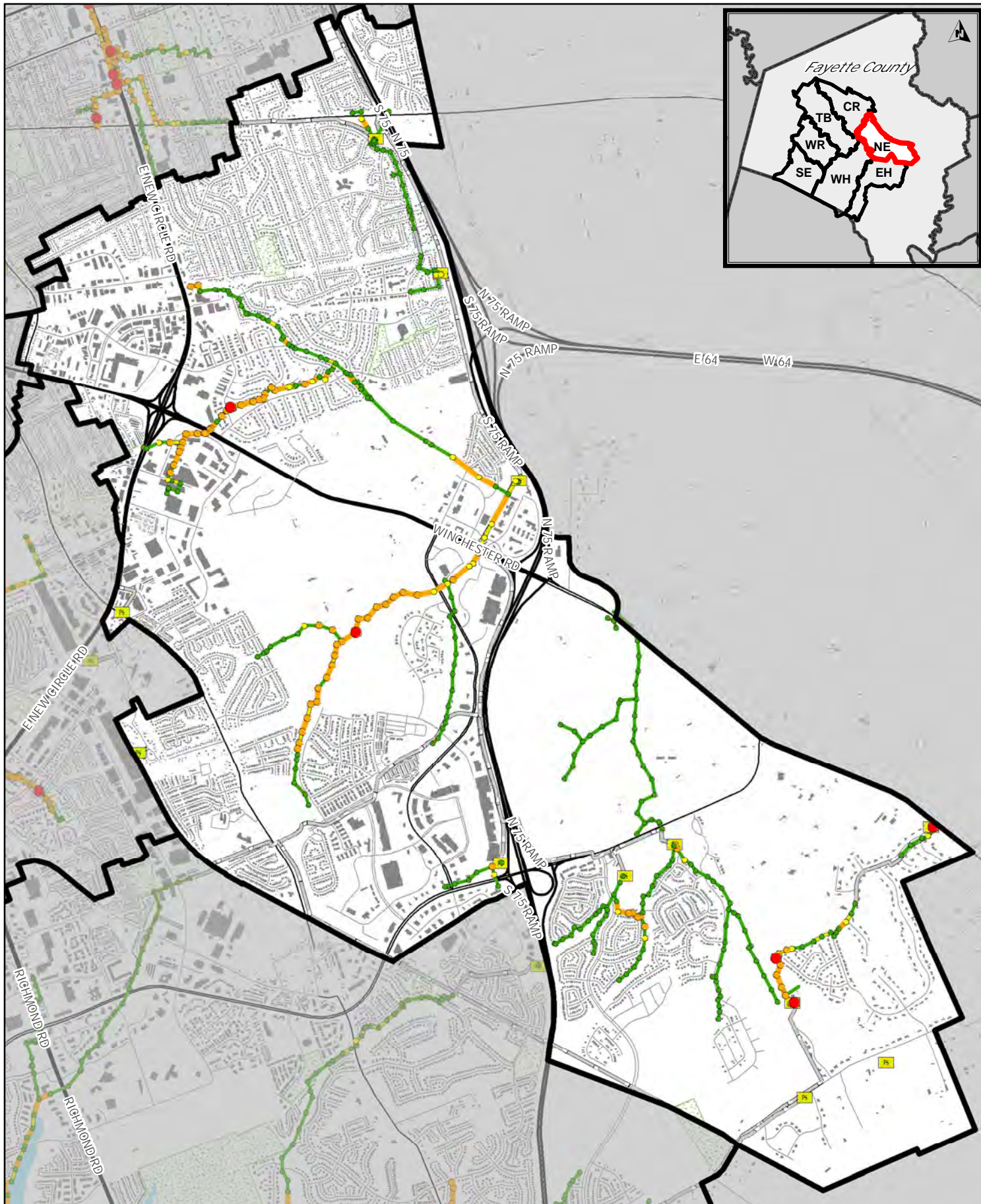


Figure:

2 - 1



1" = 3,100'

2035 2-year, 24-hour Design Storm - North Elkhorn

Modeled Manholes

- Not Surcharged
- Surcharged < 24" Over Pipe Crown
- Surcharged >= 24" Over Pipe Crown
- Overflow

Modeled Pipes

- Not Surcharged
- Near Capacity (> 75%)
- Surcharged

PS Pump Station

Force Main

Major Sewershed



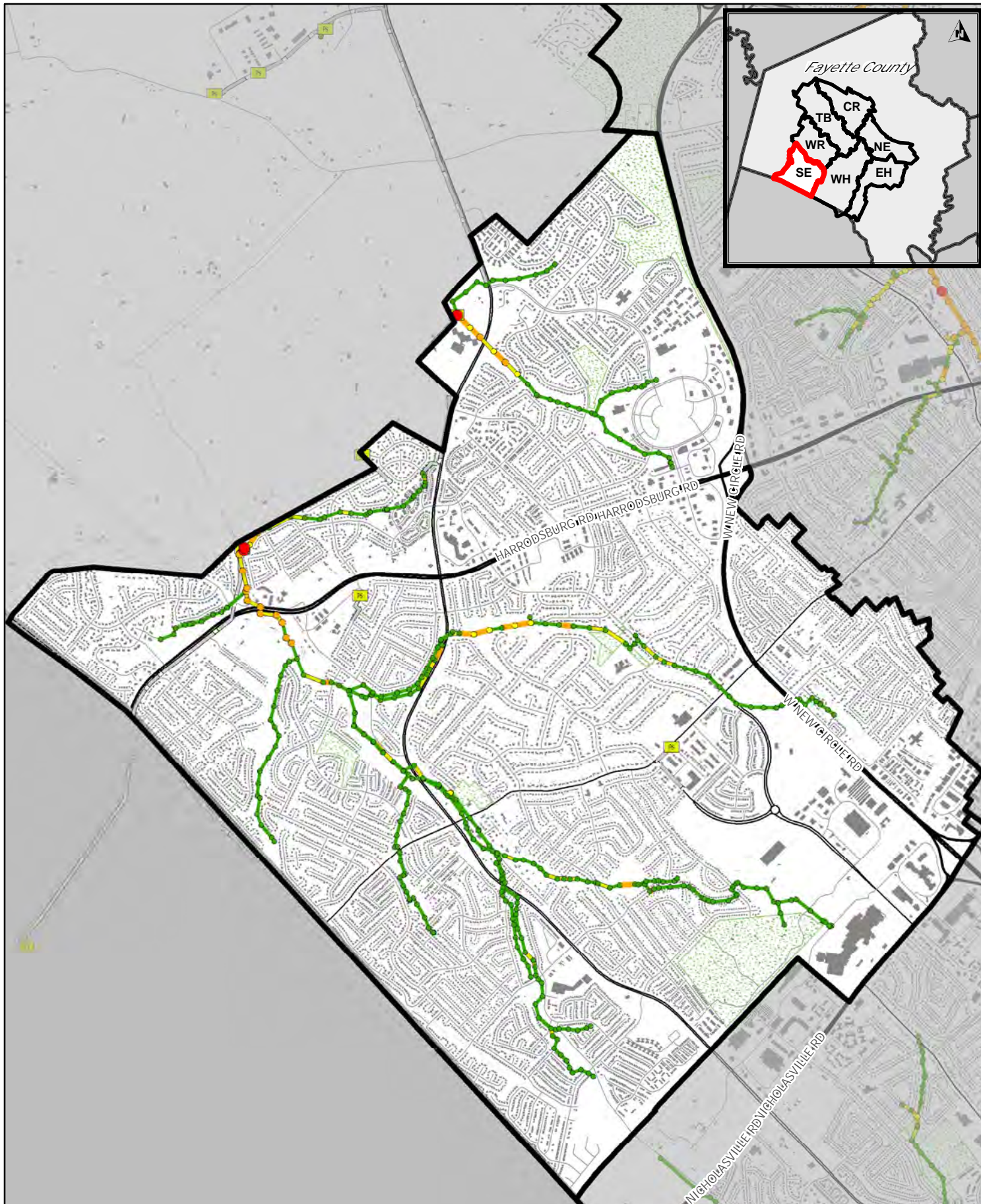


Figure:

2 - 2



1" = 3,100'

2035 2-year, 24-hour Design Storm - South Elkhorn

Modeled Manholes

- Not Surcharged
- Surcharged < 24" Over Pipe Crown
- Surcharged >= 24" Over Pipe Crown
- Overflow

Modeled Pipes

- Not Surcharged
- Near Capacity (> 75%)
- Surcharged

- Pump Station
- Force Main
- Major Sewershed



- Future residential development was projected from Traffic Analysis Zone (TAZ) data provided by LFUCG's Division of Planning.
- Dry weather flows assumed 15 gpcd for groundwater infiltration (GWI) and 65 gpcd of sanitary flow for all new residential areas.
- Existing diurnal normalized patterns were assumed for future infill and redevelopment areas.
- Rainfall dependent inflow/infiltration (RDI/I) for future development areas utilized RTK parameters observed in existing Lexington neighborhoods approximately 5 to 10 years old.
- A population density of nine persons per acre was assumed in undeveloped areas.

B. Corrective Actions Toolbox

The following measures were considered in the development of the RMP. A more detailed description of each measure can be found in the Group One RMP Report.

- Sewer rehabilitation as a means of restoring existing sewer capacity by reducing infiltration and inflow.
- Equalization storage to reduce downstream peak flows.
- Increased conveyance capacity through gravity sewer construction or pump station/force main upgrades.
- Increased wastewater treatment capacity through existing process expansion, optimization, or the use of other wet-weather treatment processes.
- Diversion of flows to other sewersheds with sufficient capacity, typically via pumping.

C. Solution Development Process

Remedial Measures Plan solutions were evaluated (and sized) using the hydraulic model assuming future conditions. Remedial measures were developed using a two-step process that involved first evaluating a generalized solution that consisted solely of conveyance upgrades and equalization storage. The generalized solution evolved into a detailed solution. A similar approach was used in the development of the Group One and Group Two RMP. A detailed explanation of the solution development process was presented in the Group One RMP report and an abbreviated summary of the approach follows.

1) General Solutions

A solution set comprised solely of upsizing existing trunk sewers was evaluated with the hydraulic model to understand the extent of conveyance upgrades necessary to eliminate SSOs and sewer surcharge conditions. The sewer surcharge condition was defined as no surcharging greater than 24 inches above the top of pipe or within 3 feet of the rim of the manhole for the one-hour peak flow, as defined in Section VII.16.B of the Consent Decree. The conveyance approach did not consider I/I removal. A storage tank at the downstream boundary condition in the North Elkhorn sewershed was assumed to capture excess wet weather flows. The

downstream boundary condition in the North Elkhorn sewershed is the North Elkhorn Pump Station with a modeled capacity of 21 million gallons per day (MGD). The boundary condition in the South Elkhorn sewershed was considered variable, as the South Elkhorn Pump Station replacement project completed in September 2010 with a firm design capacity of 17 MGD and approximately 29 MGD of peak capacity. This pump station included the potential to add additional pumping capacity up to a peak capacity of approximately 32 MGD.

The conveyance solution was then revised to include localized storage/equalization tanks. Storage tank locations were selected based on proximity to SSOs and hydraulic bottlenecks, as well as locations where property acquisition could reasonably be assumed. Evaluation of storage alternatives was used to determine their effectiveness at reducing the extents of the conveyance solution and to develop initial estimates of tank volumes needed.

The costs of the general solutions were then calculated and summarized. The results provided an understanding of the magnitude of the individual RMP solution and planning-level program costs.

2) Detailed Solutions

The conveyance and storage General Solutions provided the basic framework for development of the Detailed Solutions. Other factors were also considered when developing detailed solutions. These considerations included:

- **SSA Field Data.** The condition of the pipes in the system played a role in evaluating the benefits of conveyance solutions versus storage solutions. For example, choosing a conveyance solution (i.e. pipe upsizing or construction of a relief sewer) is likely more cost-effective than a storage tank in an area where the trunk sewer is in very poor structural condition and in need of replacement. In this case, both solutions would include the cost of trunk sewer replacement, but the local storage option would also include the cost of a storage tank. Closed-circuit television (CCTV) inspection data collected during SSA field activities was used as the basis for determining trunk sewer condition. In areas where CCTV inspection was not performed during the SSA, CCTV inspection data collected as part of the Trunk Studies performed from 1998 to 2001 was used. A graphical summary of trunk sewer condition is presented in Section 3C.
- **Storage Preferences.** LFUCG indicated an overall preference to minimize regional or remote storage unless there was a potential for significant cost savings over increasing downstream sewer capacity through upsizing or parallel relief sewers.
- **Flow Monitoring Data.** The decision to provide storage or upsize a pipe can be affected by the proposed I/I reduction strategy (see Section 4). For example, construction of equalization can be done in a phased manner to allow for an adaptive approach where the effectiveness of I/I removal can be assessed over time. This might result in lower ultimate EQ volumes. Conversely, construction of conveyance pipes is not as adaptive. It would be very risky to design a new pipe assuming a certain I/I removal rate only to

learn that I/I removal was not as successful as projected. If that were the case, additional pipe construction would be required to provide the required capacity. Therefore, the flow data was useful to identify where a long term I/I removal strategy could reasonably be expected to provide cost savings in potential storage volumes and pipe construction.

- **Cost Effectiveness.** Each solution alternative was sized to meet the 2-year, 24-hour Level of Control (LOC) under future growth conditions. Competing alternatives from the Corrective Action Toolbox (i.e. storage tanks, conveyance upgrades, flow diversions, WWTP upgrades, and I/I removal) were evaluated. Planning-level cost estimates were prepared for each competing alternative to aid in the evaluation. Only cost-effective alternatives that met the established LOC were selected.
- **Other key factors.** Other key strategic and local condition factors were taken into account when developing the detailed solutions. These factors are based on current commitments, previous planning, and other issues. These factors are summarized in the following subsection.

These factors plus the general solutions results were used to define a set of detailed solution alternatives for each watershed. Section 3 summarizes the general and detailed solutions.

D. Key Factors and Critical Decisions for Screening Solutions

Several design constraints were provided by LFUCG to guide development of the detailed solutions. These constraints are summarized by watershed.

1) All Sewersheds

Improvements are sized assuming no I/I removal. While I/I is a critical long term strategy for LFUCG, proposed remedial measures projects were developed assuming no I/I reduction. There is an inherent risk in sizing sewer improvements and equalization facilities assuming a specific I/I removal rate. Historic collection system rehabilitation efforts by LFUCG to reduce I/I have had limited success. In addition, the actual amount of I/I that can be reduced through sewer rehabilitation has the potential for significant variability and uncertainty. Conservative procedures for including I/I removal in new conveyance capacity improvements is a systematic process that involves construction of collection system rehabilitation/repairs, post-rehabilitation flow monitoring, and subsequent determination of the remaining conveyance capacity necessary to eliminate SSOs and sewer surcharging. The short time frame for elimination of recurring overflows within the Consent Decree schedule does allow for an evaluation of I/I removal effectiveness before construction of conveyance improvements. Assuming zero I/I reduction in sizing conveyance and storage improvements provides a higher probability of successfully meeting or exceeding the program goals within the RMP implementation period.

The overall long term I/I removal strategy is described in Section 4. Some utilities, including LFUCG, have elected to size RMP improvements and provide the selected level of control (LOC) without relying on I/I reduction. I/I reduction through sewer rehabilitation would increase the LOC that LFUCG could provide above the selected design storm. For instance, facilities originally designed for a two-year return period would accommodate larger storm events (without SSO or surcharging) as a result of the reduction in wet weather flows from sewer rehabilitation.

Pipe replacement was assumed for additional conveyance in all areas where upsizing was needed. When providing additional conveyance capacity, there are two options. The first option is to provide a new pipe with the ability to convey the peak flows alone. The other option is to construct a parallel relief sewer that, when combined with the capacity of the existing sewer, provides the total needed conveyance capacity. Detailed assessment is necessary to determine the costs associated with upsizing/replacement versus construction of a parallel sewer. Factors such as existing pipe condition, pipe location, bypass pumping costs, asset management goals, proximity to creeks, traffic, etc. all play a role in the decision. These factors will be evaluated during the final design of RMP improvements. Estimated costs for RMP conveyance improvements in this report assumed that existing sewers were replaced with larger pipes (i.e. upsized).

All improvements to be constructed within the current Urban Service Area unless shown otherwise in the approved Regional Facilities Plan. In 1958, the Lexington-Fayette County initiated an Urban Service Boundary as a tool to limit development to urban areas served by sanitary sewers. Planning and zoning restrictions, including minimum lot sizes, exist to limit development outside the Urban Service Boundary. The boundary serves to protect the pastoral nature of the area surrounding Lexington by encouraging land development within the Urban Service Area (USA), or that area within the Urban Service Boundary. LFUCG is committed to maintaining the USA in accordance with the Comprehensive Plan and construction or installation of the RMP improvements outside of the USA was not considered in Group 3.

Improvements should be sized to meet future Capacity Assurance Program criteria. Based on the requirements in the Consent Decree, LFUCG must implement a Capacity Assurance Program, or CAP (Section VII.16.B). Terms of the Consent Decree prohibit new connections to the sanitary sewer system where sewers do not have adequate capacity to pass wet weather flows where a surcharge condition exists, unless a banking credit system is utilized. A surcharged condition is defined as sewer surcharging from the one-hour peak flow greater than 24 inches above the top of the pipe or within 36 inches of the manhole rim.

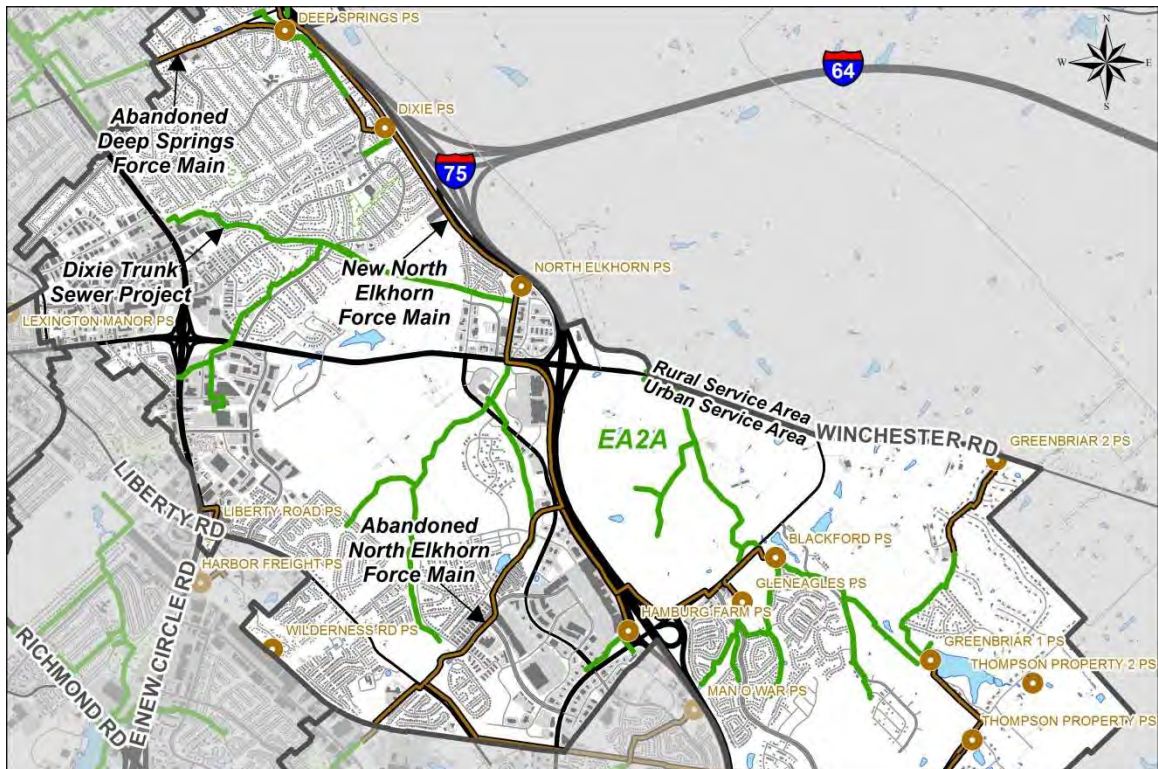
LFUCG identified that, in general, proposed RMP improvements should be sized to eliminate the surcharged condition as defined in the Consent Decree. Exceptions were permitted, in areas where surcharge conditions were predicted by the hydraulic model but the existing

facilities are in acceptable condition and there was no reasonable anticipation of future development. Areas within the Group Three sewersheds where sewer surcharge conditions are predicted to occur after implementation of the RMP improvements are summarized in Section 3C.

2) North Elkhorn Sewershed

A map illustrating existing sewer assets discussed below is provided in Figure 2-3.

Figure 2-3: Existing Sewer Assets – North Elkhorn



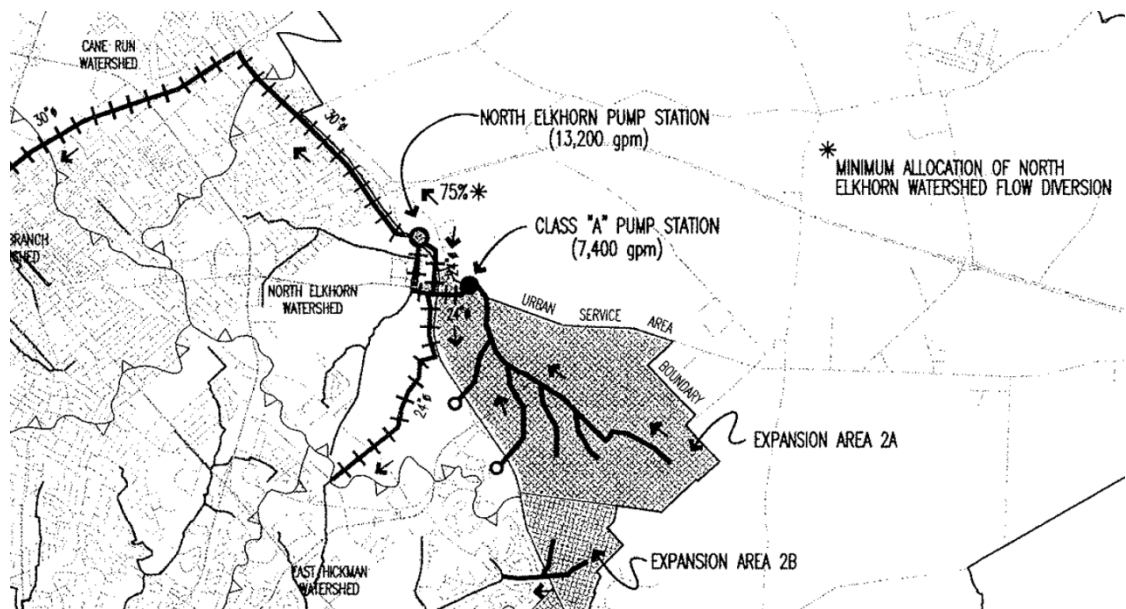
North Elkhorn Pump Station – The North Elkhorn Pump Station was recently replaced by a new station with peak capacity of 21 MGD. An equalization tank near the pump station was identified as the preferred alternative to handle excess wet weather flows.

Dixie and Deep Spring Pump Station and Force Main Replacements – Sewer flows to the old Dixie and Deep Springs pump stations discharged to the Cane Run sewershed. Both pump stations were identified as SSOs in Appendix A of the Consent Decree. The Dixie and Deep Springs pump stations were replaced in 2012 to eliminate recurring SSOs identified in Appendix A of the Consent Decree. New force mains for both pump stations were constructed that connect to the recently completed force main sewer for the North Elkhorn pump station and discharge directly to the Town Branch WWTP. RMP improvements were designed considering that Dixie and Deep Springs pump station discharges were diverted to the North Elkhorn force main sewer.

Dixie Trunk Sewer Project – The Dixie Trunk Sewer was replaced/upsized in 2003 to alleviate recurring SSOs along the trunk. Construction conflicts due to surface terrain along an old railroad bed were encountered during the project at the upstream end of the project. As a result, the two upper-most trunk sewers were not replaced in 2003. Current modeling results indicate that the Dixie Trunk Sewer Project eliminated the recurring SSOs, but a surcharge condition still exists near the upstream end of the trunk. A rehabilitation or I/I removal approach upstream was considered as the preferred remedial measure alternative for this trunk sewer.

Expansion Area No. 2A (EA2A) – LFUCG revised the Urban Service Boundary in 1996 to allow for growth within approximately 2,400 acres of land east of I-75 and south of Winchester Road. Since then, approximately 1,600 acres southeast of Man o' War Boulevard have been developed. The remaining 800 acres between Winchester Road and Man o' War Boulevard are currently undergoing sanitary sewer infrastructure projects to accommodate future development and eliminate smaller pump stations that were constructed to facilitate the earlier development phases. The area is adjacent to the Hamburg Farm, Man o' War, Gleneagles, Blackford, and Greenbriar 1 pump stations. Topographically, the service areas for these pump stations drain through EA2A. LFUCG's last approved 201 Facilities Plan Update included the elimination of these pump stations through construction of new gravity sewers through EA2A and a new pump station. The primary gravity trunks have been constructed in EA2A, the construction contract for the new EA2A pump station has been awarded, and the force main sewer and connections to the existing pump stations to be eliminated are currently in the design and easement acquisition phase. These projects are included in the RMP along with associated costs. Flow from the existing pump stations will be rerouted to the new Expansion Area 2A Pump Station. The Man o' War, Gleneagles, Blackford, and Greenbriar 1 pump stations will be eliminated. The EA2A pump station will pump directly to the existing North Elkhorn Pump Station. A map illustrating EA2A excerpted from LFUCG's last approved Facilities Plan is presented in Figure 2-4.

Figure 2-4: EA2A Solution from LFUCG's Facilities Plan



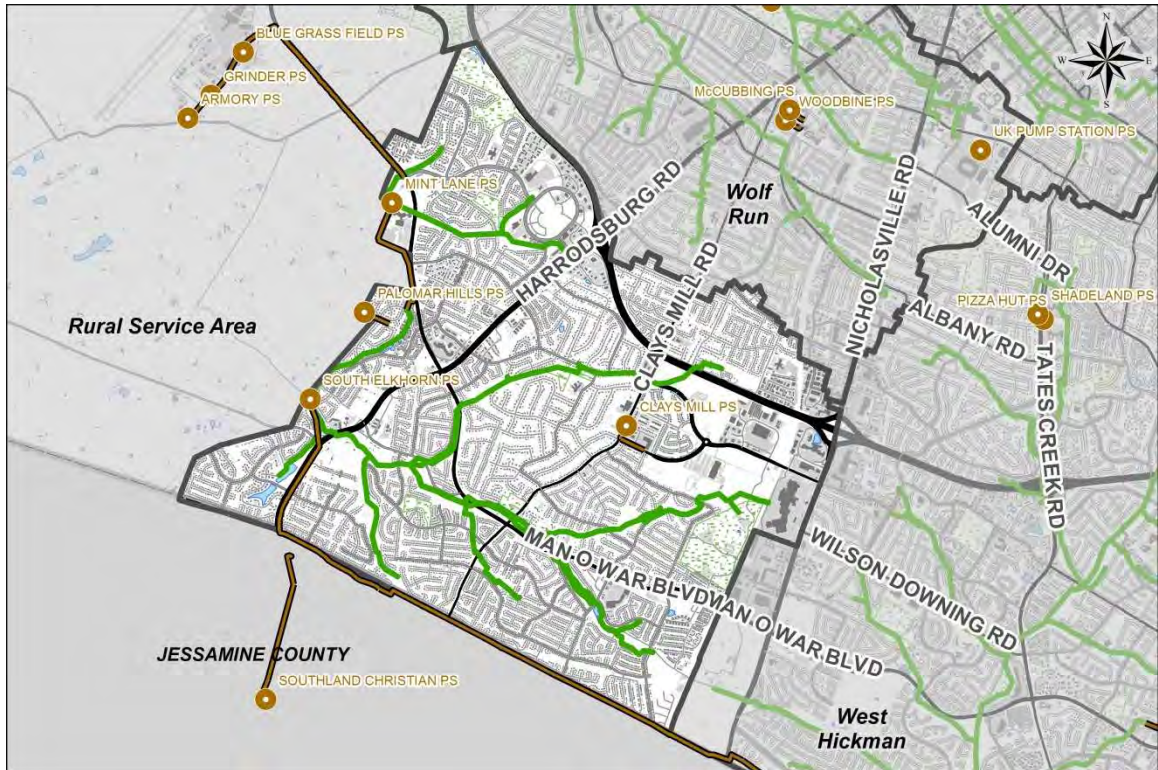
Greenbriar 2 Pump Station – The Greenbriar 2 Pump Station is located at the northeastern edge of EA2A near Winchester Road at the intersection of Bahama Road. The pump station service area drains naturally to the north across Winchester Road and outside the Urban Service Area. LFUCG has elected to avoid infrastructure construction outside of the Urban Service Area where possible. Greenbriar 2 Pump Station has a history of wet weather SSOs and is listed as a recurring SSO in Appendix A of the Consent Decree. LFUCG has elected to replace the existing pump station. The new pump station will have sufficient capacity to eliminate SSOs for the established LOC.

Thompson Property 1 and 2 Pump Stations – The Thompson Property Pump Stations were constructed in conjunction with recent development along Walnut Grove Road at the eastern edge of EA2A. The pump stations currently pump south into the East Hickman sewershed and ultimately through the East Hickman Pump Station to the West Hickman WWTP. Preliminary review of topographic relief in the area indicates that the pump stations may be eliminated by gravity sewers draining to the north (and through EA2A). The Thompson Property Pump Stations and upstream service areas do not experience recurring SSOs; however, it is anticipated that in the future the pump station will be eliminated and flows diverted to the North Elkhorn sewershed and EA2A. Elimination of the Thompson Property Pump Stations was not considered as an RMP improvement project, but flows from their service areas were assumed to drain to EA2A in the hydraulic model used for sizing/evaluating RMP improvements.

3) South Elkhorn Sewershed –

A map illustrating existing sewer assets discussed below is provided in Figure 2-5.

Figure 2-5: Existing Sewer Assets – South Elkhorn



South Elkhorn Pump Station – The South Elkhorn Pump Station is identified as an SSO in Appendix A of the Consent Decree and reconstruction of the pump station was identified as an early action project in Section VII.15.A. of the Consent Decree. This pump station was replaced in 2010 with a design capacity of about 17 MGD; however, the current peak wet weather capacity of the pump station after reconstruction is approximately 29 MGD. The pump station now consists of five (5) pumps, but the wet well is configured for the addition of a sixth pump to accommodate excess wet weather flows in the future. The pump station replacement project also included about seven (7) miles of new 36-inch force main that redirects flows from a gravity sewer in the West Hickman sewershed directly to the West Hickman WWTP. RMP improvements were designed considering this project. LFUCG also elected to include the installation of the sixth pump at the South Elkhorn Pump Station as a remedial measures project to accommodate future flows in excess of the current 28 MGD peak capacity.

Jessamine County Future Flows – Jessamine County is situated directly south of LFUCG and currently has a sewer agreement with LFUCG. Existing Jessamine County sewage flows are pumped into both the South Elkhorn and West Hickman sewersheds and flow estimates in South Elkhorn were measured via flow meters near existing trunk sewers in the South Elkhorn

sewershed. RMP improvements at the West Hickman WWTP accommodate the projected future flows from Jessamine County up to approximately 2 MGD of average daily flow and approximately 6 MGD during the design storm. Future flow projections in Jessamine County are assumed to discharge directly to the West Hickman WWTP and therefore have not been considered in designing the RMP improvements in the South Elkhorn sewershed.

Bluegrass Field Pump Station – The Bluegrass Field Pump Station is identified as an SSO in Appendix A of the Consent Decree and was evaluated as part of the Pump Station Design, Capacity, and Equipment Adequacy Evaluation. The pump station has recently been upgraded to eliminate the recurring SSO and a new force main was constructed that redirected flow from the Wolf Run sewershed to the South Elkhorn sewershed upstream of the Mint Lane Pump Station. RMP improvements were designed considering that the pump station discharges were diverted to South Elkhorn.

Mint Lane Pump Station – The Mint Lane Pump Station is identified as an SSO in Appendix A of the Consent Decree and was evaluated as part of the Pump Station Design, Capacity, and Equipment Adequacy Evaluation. The primary cause of SSOs is believed to be related to poor pump performance and pump reliability during wet weather events. Additionally, LFUCG has had a history of maintenance problems at the pump station. RMP improvements anticipated are to increase reliability and wet weather capacity at this pump station.

E. Costing Tool

At the onset of the RMP process it was acknowledged that a consistent and credible basis for establishing costs was essential to the decision-making process. As such, it was determined that a costing tool would be developed to assure that consistent and justifiable planning-level costs are applied to RMP alternatives. Therefore, a custom Microsoft Access based costing tool was used to develop and compare and manage multiple solutions for consideration.

The base costing tool was developed from a similar tool used for developing the RMP for another EPA Region 4 community. This baseline tool was refined to meet the needs of the LFUCG RMP. The accuracy of the individual estimates was based upon the Association for the Advancement of Cost Engineering (AACE), Class 4 standards, which is appropriate for planning-level cost estimates. The cost curves included in the costing tool were originally developed using a “bottom-up” costing procedure for a range of facility types and facility sizes. Cost curves were developed for the following facilities that comprise RMP improvements:

- Gravity sewers
- Pump stations
- Force mains
- Equalization storage
- Storage/conveyance tunnel
- Tunnel shafts

The construction cost estimates and cost curves/equations were then confirmed and refined through a variety of sources including:

1. Recent bid information from LFUCG;
2. Recent bid information for equalization tanks used for SSO control;
3. Planning level cost information developed by the consulting team for other studies; and,
4. EPA Technology Fact Sheets, WERF studies and similar reference material.

The initial construction costs were then converted to full capital costs to be used for remedial measures project estimates. The Kentucky USDA/Rural Development Utility Program Fee Schedule was used for estimating fees for professional engineering services and resident project representative services as a percentage of initial construction costs. These costs are commonly referred to as basic design and inspection costs respectively. The total capital cost also includes other factors as a percentage of the initial construction cost and possible land acquisitions where it was deemed as a necessity. The total capital costs were developed by applying these aforementioned factors to the initial construction costs; these factors are shown in Table 2-2 below.

Table 2-1: Capital Cost Factors

| Item | Percentage | Notes |
|------------------|--------------|---|
| Basic Design | 6.4% to 14% | Of Initial Construction Cost; based on Rural Development Fee Curve (RD 1942-19) |
| Inspection | 3.05% to 13% | Of Initial Construction Cost; based on Rural Development Fee Curve (RD 1942-19) |
| Land Acquisition | -- | \$100k purchase or \$1k easement / acre |
| Contingency | 30% | Of Initial Construction Cost |
| Administration | 1% | Of Initial Construction Cost |
| Legal/Finance | 5% | Of Initial Construction Cost |

Annual operation and maintenance costs were developed by applying a percentage to the capital cost. These percentages are based on previous experience and are as follows:

- Gravity Sewers: 1% of construction costs
- Equalization Tanks: 2% of construction costs
- Force Mains: 2% of construction costs
- Pump Stations: 3.5% of construction costs

F. Public Involvement

Throughout the work conducted for the SSA field investigations, the preparation of the Group One, Group Two, and Group Three SSSA Reports, the Group One and Group Two Remedial Measures Plans and this Group Three Remedial Measures Plan, LFUCG has consistently kept the public informed of the Consent Decree compliance process and progress. They have also solicited

input from the public, community stakeholders, and public policymakers related to key decisions required for the RMP development. The following meetings were held as part of this public involvement process:

- Fayette County Neighborhood Association – January 27, 2011
- Fayette County Public Schools – February 3, 2011
- Lexington Homebuilders Association – February 10, 2011
- Commerce Lexington (Chamber of Commerce) – February 24, 2011
- LFUCG Stormwater Stakeholders – March 4, 2011
- Public information meetings for residents – March 7, 14 and 21, 2011
- LFUCG Environmental Quality Commission presentations:
 - January 18, 2011
 - April 19, 2011
 - June 21, 2011
- LFUCG Mayor and Chief Administrative Officer – June 22, 2011
- LFUCG Council Committee of the Whole – August 23, 2011
- Presentation of the Group Two RMP to the University of Kentucky – December 16, 2011
- Presentation of the Group One RMP to residents – September 12 and 19, 2011
- Presentation of the Group Two RMP to residents – February 27 and March 5, 2012
- Presentation of the Group Two RMP to Lexmark International – March 12, 2012
- Presentation of the Group Three RMP to residents – September 10, 2012

In addition to the meetings listed above, a web page was established within the Lexington government website to provide access to critical information and documents, and to allow the public to view the progress of the various initiatives. This website (<http://www.lexingtonky.gov/RemedialMeasures>) will be maintained throughout the implementation of the remedial measures, so that residents and other stakeholders are informed of work anticipated or under way in their neighborhoods.

Section 3 Remedial Measures Development

This section summarizes the development of the Group Three Remedial Measures Plan. The methodology used was consistent with the RMP Development for Groups One and Two. This section includes:

- Selection of the level of control
- General solution results
- Detailed solution development and analysis
- Cross connections
- Pump station reliability and capacity upgrades

A. Selection of Level of Control (LOC)

One of the most important decisions in developing the RMP is to decide on the target Level of Control (LOC). The LOC refers to conditions within the collection system that are considered acceptable under specified situations. For example, a LOC might be defined as having no overflows resulting from a 2-year return period design storm model simulation. An LOC may be defined by something other than overflows; for example, the level of control may be defined by a level of surcharging in the collection system.

While evaluating the appropriate target LOC for the LFUCG, key definitions and requirements contained within the Consent Decree were considered. Following are some key definitions from the Consent Decree:

- **One Hour Peak Flow (Capacity Assurance Program Only):** The greatest flow in a sewer averaged over a sixty minute period at a specific location expected to occur as a result of a representative 2-year 24-hour storm event.
- **Peak Flow (Capacity Assessment and RMP):** Shall be determined based upon sound engineering judgment and commonly accepted design practice.
- **Recurring SSO:** An SSO that occurs in the same location more than once per twelve month rolling period.
- **Unpermitted Bypass:** Any discharge to the Waters of the United States from any of LFUCG's WWTPs which constitutes a prohibited bypass as defined in 40 CFR 122.41(m) and 401 KAR 5:065 Section 1(13).
- **Surcharged Condition (Capacity Assurance Program Only):** The condition that exists when the supply of wastewater resulting from the One-Hour Peak Flow is greater than the capacity of the pipes to carry it and the surface of the wastewater in manholes rises to an elevation greater than 24 inches above the top of the pipe or within 36 inches of the manhole rim.

The Consent Decree requires LFUCG to develop the RMP to eliminate Recurring SSOs and Unpermitted Bypasses. In the selection of the target LOC for LFUCG it is important to consider the following:

- It is fiscally impractical to completely eliminate all SSOs and unpermitted bypasses under all conditions.
- KRS 224.16-040 sets forth factors that must be considered when reviewing the RMP. These factors include cost-effectiveness, which is a component of this plan.

LOC selection considered cost-effectiveness, Consent Decree requirements, stakeholder preference, and LOCs adopted by other Region 4 utilities. A detailed evaluation of these considerations was included in the Group One RMP Report.

After careful deliberation and public scrutiny, Resolution No. 389-2011 was passed by the Lexington-Fayette Urban County Council on September 15, 2011. The resolution formally adopted the 2-year, 24-hour storm event as the LOC for the LFUCG Sanitary Sewer System and WWTP Remedial Measures Plan. This LOC will be adopted for all three sewershed Groups. A copy of the resolution is presented in Figure 3-1.

RMP improvement alternatives were developed to eliminate all recurring SSOs and unpermitted bypasses for the established LOC. Additionally, improvement alternatives were developed, to the extent practical, to eliminate many surcharged conditions (as defined in the Consent Decree) within the sewer system. Surcharged conditions were defined in the Capacity Assurance Program (CAP) portion of the Consent Decree and RMP improvement alternatives are not required to meet CAP criteria. In most cases, RMP improvements eliminated surcharged conditions in the Group Three sewersheds for the established LOC. It should be noted that for some sewer segments it was impractical to eliminate sewer surcharging due to localized issues. Areas where surcharged conditions persist are summarized in Section 3C.

B. General Solutions

General Solutions were developed for the North Elkhorn and South Elkhorn sewersheds and consisted of exploring two generalized alternatives as described in Section 2. They were:

- **General Solutions Conveyance Improvements.** Increasing hydraulic capacity of gravity sewers (i.e. through upsizing or parallel relief sewers) to the extent necessary to eliminate SSOs and sewer surcharging for the established LOC. A regional equalization (EQ) tank or increased pump station capacity at the sewershed boundaries were sized to capture excess wet weather flows.

Figure 3-1: Resolution formally adopting a 2-year, 24-hour Level of Control

RESOLUTION NO. 389 -2011

A RESOLUTION APPROVING THE RECOMMENDATION OF THE DIVISION OF WATER QUALITY TO SELECT A "TWO-YEAR/24 HOUR" STORM EVENT AS THE "DESIGN STORM" TO FORM THE BASIS OF IMPLEMENTATION OF THE LFUCG SANITARY SEWER SYSTEM REMEDIAL MEASURES PLANS REQUIRED BY THE U.S. EPA CONSENT DECREE.

WHEREAS, the Urban County Government, the United States Environmental Protection Agency ("EPA"), and the Commonwealth of Kentucky have entered into a Consent Decree in a case styled *United States, et al. v. Lexington-Fayette Urban County Government*, United States District Court for the Eastern District of Kentucky, Case No. 5:06-CV-00386 ("Consent Decree"), wherein the Urban County Government is required to develop Remedial Measure Plans to address wet weather overflows and sewer capacity related issues; and

WHEREAS, the Consent Decree requires the Urban County Government to eliminate Sanitary Sewer Overflows (SSOs) with 11 to 13 years of January 3, 2011; and

WHEREAS, pursuant to the Consent Decree failure to meet the SSO elimination criteria will result in significant, recurring, and cumulative financial penalties; and

WHEREAS, failure to meet the requirements of the Consent Decree is likely to result in further legal action by the United States Department of Justice; and

WHEREAS, the Consent Decree requires three separate "Remedial Measures Plans" (Group 1, Group 2, and Group 3) broken down by watershed; and

WHEREAS, each Remedial Measures Plan (RMP) must recommend a "design" storm to provide a basis for sizing of sanitary sewer infrastructure (pipes, pump stations, storage tanks, and treatment plants); and

WHEREAS, the Group 1 Remedial Measures Plan is due to be sent to the EPA in October 2011; and

WHEREAS, the Division of Water Quality has employed expert engineering services to study the appropriate design standards for LFUCG's sanitary sewer system, held numerous public meetings to gain input from Fayette County residents, and otherwise considered the appropriate "design" storm to

Figure 3-1: Resolution formally adopting a 2-year, 24-hour Level of Control (cont.)

form the basis of the Remedial Measures Plans to comply with the Consent Decree; and

WHEREAS, the Division of Water presented the Urban County Council with detailed information related to costs and benefits of various "design storms" and has recommended that a "Two-Year/24 Hour" storm event is the appropriate "design storm" to form the basis of the sanitary sewer system Remedial Measures Plans to comply with the requirements of the Consent Decree; and

WHEREAS, after consideration the Urban County Council agrees with the recommendation of the Division of Water Quality;

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE LEXINGTON-FAYETTE URBAN COUNTY GOVERNMENT:

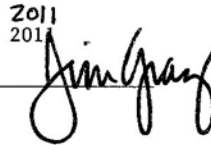
Section 1 - That the recommendation of the Division of Water Quality that a "Two-Year/24 Hour" storm event is the appropriate "design storm" to form the basis of the LFUCG sanitary sewer system Remedial Measures Plans to comply with the requirements of the Consent Decree be and hereby is approved.

Section 2 - That a "Two-Year/24 Hour" storm event be and hereby is adopted as the "design storm" to form the basis of the LFUCG Sanitary Sewer System Remedial Measures Plans required to be implemented by the Consent Decree.

Section 3 - That this Resolution shall become effective on the date of its passage.

PASSED URBAN COUNTY COUNCIL: September 15, 2011

MAYOR



ATTEST:


CLERK OF URBAN COUNTY COUNCIL

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- **General Solutions Local Storage/Equalization.** Evaluation of equalization basins/storage tanks at selected locations where storage could reasonably be considered to eliminate SSOs and sewer surcharging (CAP criteria) for the established LOC. Proposed locations for local storage/equalization were vetted by LFUCG to determine reasonableness of property acquisition and constructability. The intent of the GS2 solution was to identify required storage volumes necessary to meet the established LOC and areas where conveyance improvements could be reduced through construction of localized storage facilities.

For both General Solutions options, improvements were sized to eliminate SSOs and sewer surcharging (CAP criteria) for the established LOC under future year (2035) conditions.

1) North Elkhorn Sewershed General Solutions

The North Elkhorn sewershed includes six (6) of the seventy-one (71) manhole SSOs and seven (7) of the twenty-four (24) pump station SSOs identified in Appendix A of the Consent Decree. There are no identified cross connections between the sanitary sewer and stormwater systems in North Elkhorn. The seven (7) pump station SSOs identified in Appendix A of the Consent Decree include Deep Springs, Dixie, Greenbriar 1, Greenbriar 2, Hamburg Farm, Man o' War and North Elkhorn pump stations. Man o' War Pump Station is actually located in the East Hickman sewershed, but it will be eliminated and its service area flow will be conveyed via new gravity sewers to the North Elkhorn sewershed with the completion of the Expansion Area 2A projects. The disposition of Appendix A SSOs is presented in Appendix A. The boundary condition considered for the North Elkhorn sewershed was the North Elkhorn Pump Station. Flows to the pump station in excess of 21 MGD were assumed to be diverted to a proposed equalization tank (EQ) located adjacent to the pump station for the general solutions alternatives. Additionally, the general solutions assumed that the capacities of SSO pump stations were increased to meet the established LOC.

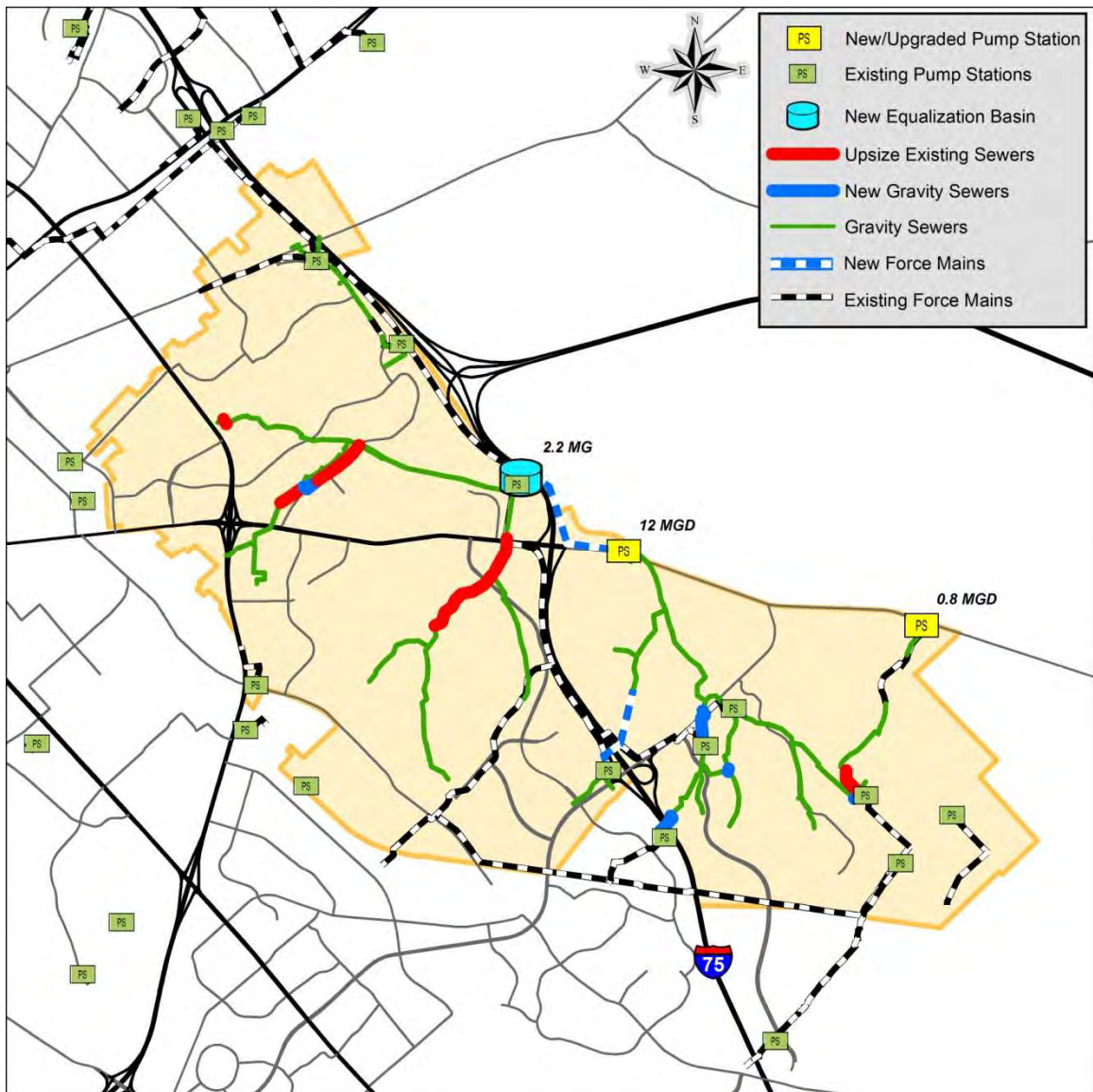
Projects to replace the existing Dixie and Deep Springs pump stations and force mains are substantially complete. Prior to construction of these projects, the Dixie Pump Station discharged to the service area for the Deep Spring Pump Station which, in turn, discharged to the eastern end of the Cane Run sewershed. New force mains for each pump station have been constructed that will redirect discharges from each pump station directly into the recently completed force main for the North Elkhorn Pump Station. Additionally, LFUCG is currently implementing projects in Expansion Area 2A (EA2A). The EA2A projects will eliminate four (4) smaller pump stations, including the SSO pump stations at Greenbriar 1 and Man o' War pump stations. The general solutions took into consideration the completion of the Dixie, Deep Springs, and North Elkhorn pump station and force main diversion projects as well as the EA2A projects.

The general solutions conveyance alternative included upsizing upstream trunk sewers and increasing pump station capacities at SSO pump stations necessary to convey flows from the 2-year, 24-hour design storm without overflow or system surcharging (CAP criteria). A

graphical summary of the pipes that require upsizing under the conveyance alternative is presented in Figure 3-2.

The general solutions localized storage alternative included the consideration of local equalization tanks that have the goal of reducing or eliminating downstream conveyance upsizing. LFUCG performed a detailed review of locations where siting was feasible, proximity to SSOs and hydraulic bottlenecks, and other areas where opportunities to reduce the extent of conveyance upgrades appeared reasonable. After reviewing the limited portions of required conveyance upgrades identified in the general solutions conveyance alternative, it was determined that further evaluation of localized tank sites was not warranted.

Figure 3-2: Conveyance Improvements General Solution –North Elkhorn



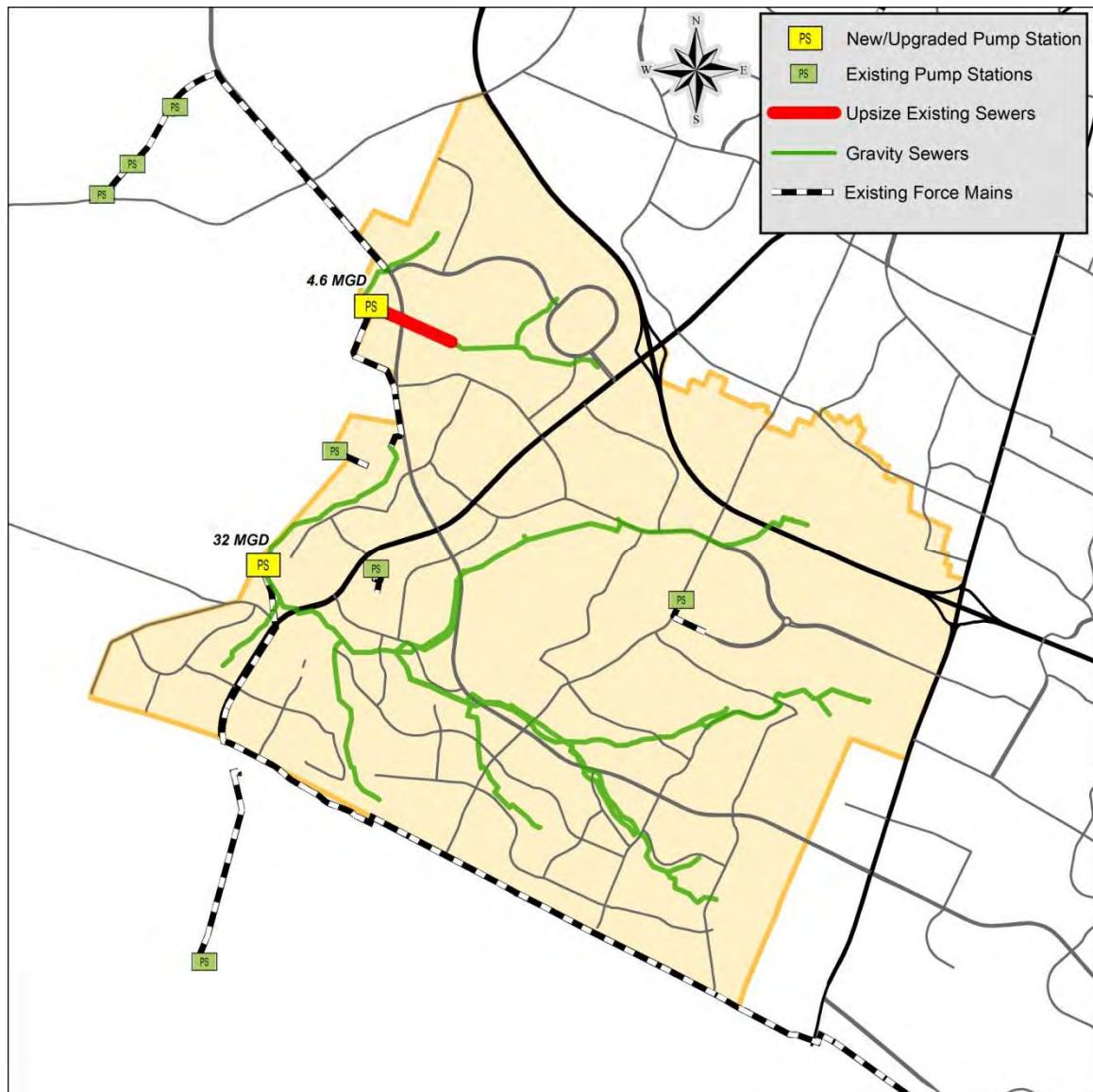
2) South Elkhorn Sewershed General Solutions

The South Elkhorn sewershed includes none of the seventy-one (71) manhole SSOs, none of the nine (9) cross-connections, and three (3) of the twenty-four (24) pump station SSOs identified in Appendix A of the Consent Decree. The three (3) pump station SSOs identified in Appendix A of the Consent Decree include Bluegrass Field, Mint Lane, and South Elkhorn pump stations. The disposition of Appendix A SSOs and cross-connections is presented in Appendix A. The boundary condition considered in the general solutions was considered variable, because the South Elkhorn Pump Station replacement project completed in September 2010 with a firm design capacity of 17 MGD included the potential to add additional pumping capacity. South Elkhorn Pump Station currently has a peak capacity of approximately 29 MGD and as part of this RMP it is proposed to upgrade the maximum capacity to approximately 32 MGD, due to the redirection of Bluegrass Field Pump Station, proposed increases in the Mint Lane Pump Station capacity, and limited future growth. The general solutions assumed the South Elkhorn Pump Station capacity would be increased to transmit wet weather flows not to exceed approximately 32 MGD.

The Bluegrass Field Pump Station and force main diversion project was completed in January 2011. The project resulted in diversion of flows at the Bluegrass Airport from the Wolf Run sewershed to the South Elkhorn sewershed just upstream of the Mint Lane Pump Station. The general solutions took into consideration the completion of the Bluegrass Field Pump Station and force main diversion project.

The general solutions conveyance alternative included upsizing upstream trunk sewers and increasing the Mint Lane Pump Station capacity necessary to convey flows from the 2-year, 24-hour design storm without overflow or system surcharging (CAP criteria). A graphical summary of the general solutions is presented in Figure 3-3.

The general solutions localized storage alternative included the consideration of local equalization tanks that have the goal of reducing or eliminating downstream conveyance upsizing. LFUCG performed a detailed review of locations where siting was feasible, proximity to SSOs and hydraulic bottlenecks, and other areas where opportunities to reduce the extent of conveyance upgrades appeared reasonable. After reviewing the limited portions of required conveyance upgrades identified in the general solutions conveyance alternative, it was determined that further evaluation of localized tank sites was not warranted.

Figure 3-3: Conveyance Improvements General Solution – South Elkhorn

C. Detailed Solutions

Results from the general solutions were used to aid in formulating RMP improvements. Detailed solutions were developed based on applying the methodology and criteria outlined in Section 2. For both sewersheds, proposed RMP improvements were divided into discrete projects and entered into the costing tool to develop planning-level cost estimates. Preliminary field investigations and desktop reviews were performed, as necessary, to determine project feasibility and screen for potential fatal flaws.

For proposed tank locations near the North Elkhorn Pump Station, preliminary dimensions were established assuming above-ground tank (pump in, gravity discharge) structures with a maximum

tank height of 25 feet. Preliminary tank dimensions were then compared to determine the land footprint required. It should be clarified that while storage tanks were assumed to above-ground structures for RMP development, actual tank configurations will be determined during final design. Below ground storage tank and/or open-air equalization basin configurations may be considered by LFUCG.

For conveyance improvements, preliminary field investigations were performed to evaluate if improvements to sewer alignment were warranted and identify major constructability concerns. In general, preference was given to utilizing existing sewer alignments. This approach was primarily adopted to avoid potential delays associated with new property/easement acquisition. Several opportunities for sewer realignment were identified to avoid constructability concerns, improve existing sewer alignment, or reduce hydraulic inefficiencies. When these occurred, the existing sewer alignment and an alternate alignment were considered. The preferred alignment will be determined by LFUCG during final design. For costing purposes in the RMP, conveyance improvement projects were estimated assuming sewer replacement along the existing alignment.

The following sub-sections briefly summarize highlights of the detailed solution and key decisions for each Group Three sewershed.

1) North Elkhorn Sewershed Detailed Solutions

Trunk Sewer Condition

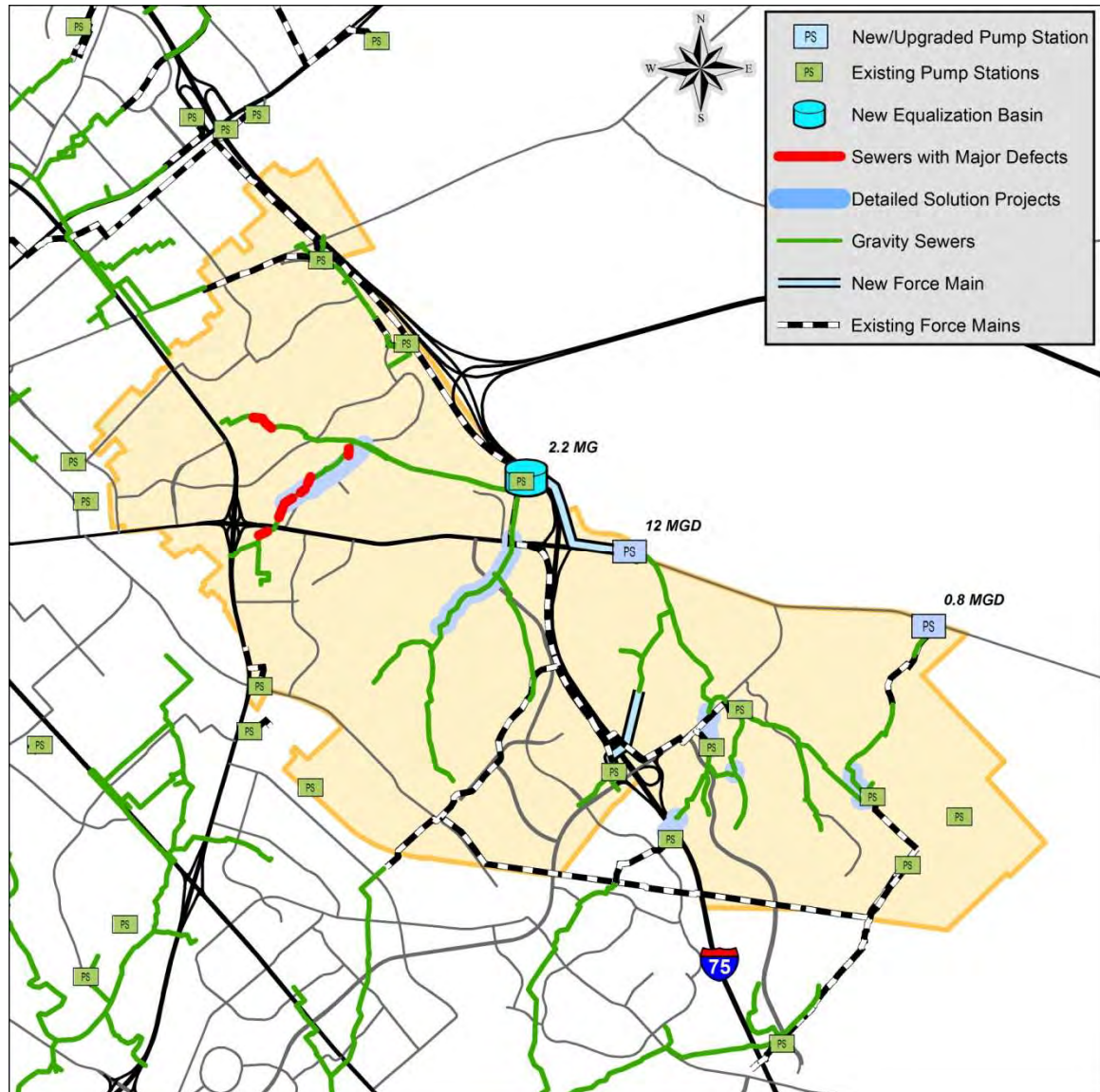
CCTV inspection was performed during SSA field activities on approximately 6 percent of the sewers in the North Elkhorn sewershed. In areas where CCTV inspection was not performed during SSA field activities, CCTV inspection information collected during the 1998 – 2001 Sewer Trunk Studies was used. Sewer condition information from both CCTV efforts was reviewed and used to identify major structural defects within the modeled trunk sewers. Major structural defects were defined as those with a Grade of 4 or 5 according to the Pipeline Assessment Certification Program (PACP). Pipe deformation in high-density polyethylene (HDPE) or polyvinyl chloride (PVC) pipes were omitted from the major defects category. CCTV performed during the 1998-2001 Trunk Studies was not coded to PACP. CCTV logs from these activities were reviewed manually and defects with an equivalent PACP Grade 4 or 5 were identified.

CCTV inspection information was used to gain a general understanding of sewer condition and salvage value. Sewer condition was considered in decision making between competing RMP improvement alternatives. For example, when a localized storage tank or relief sewer was considered to avoid upsizing downstream trunk sewers, the condition of the downstream sewer was reviewed. If the downstream sewer was in need of replacement, then it was sized for the design flow and the need for the storage tank or relief sewer was eliminated.

A map showing proposed conveyance improvements in the recommended Remedial Measures Plan and trunk sewer condition is presented in Figure 3-4. Trunk sewers identified

with major defects that will not be replaced by RMP conveyance improvements will be addressed by LFUCG as part of the annual rehabilitation/asset renewal activities outlined in their Capacity, Management, Operation and Maintenance (CMOM) program.

Figure 3-4: Trunk Sewer Condition with Detailed Solution – North Elkhorn



Recommended RMP Improvements

Based on flow contributions summarized in Section 3 (B)(1), the following is a summary of the proposed RMP improvements in the North Elkhorn Sewershed.

- 1. North Elkhorn Pump Station Equalization Tank** - Construction of a 2.2 MG storage tank adjacent to the existing North Elkhorn Pump Station. Proposed storage avoids replacement/upgrade of the North Elkhorn Pump Station and eliminates SSOs at the pump station for 2-year level of control.

2. Eastland Trunk – Upsize/replacement of 865 linear feet of existing 12-inch trunk sewer to 15-inch diameter, construction of 558 linear feet of 15-inch new gravity relief sewer to connect to an existing 8-inch collector sewer at manhole NE1_686, and upsize/replacement of 1,672 linear feet of the existing 8-inch collector sewer downstream of manhole NE1_686 to 15-inch diameter. Additional relief sewer alignments are also being considered near the upstream end of the project and the preferred alignment will be determined during final design.

3. Liberty Road Trunk – Upsize/replacement of 2,486 linear feet of existing 18-inch trunk sewer to 21-inch diameter and upsize/replacement of 1,097 linear feet of existing 21-inch trunk sewer to 24-inch diameter.

4. Greenbriar 2 Pump Station Replacement - Construction of a new 0.8 MGD pump station. The existing pump station is located in the median of Bahama Road at the intersection with Winchester Road and is not a preferable site. A new pump station site will be evaluated during final design. Improvements to the force main are not anticipated, except for the extension and reconnection at the new pump station site.

5. Greenbriar Trunk – Upsize/replacement of 1,050 linear feet of existing 8-inch collector sewer to 10-inch diameter.

6. Floyd Drive Area Collection System Rehabilitation - Rehabilitation and I/I removal in the wastewater collection system upstream of the Dixie trunk sewer in the Floyd Drive area. The area is a mix of commercial and residential property and sewers are predominantly vitrified clay pipe. An approximately 25-percent reduction in rainfall dependent I/I (RDII) is necessary to eliminate surcharging greater than 24 inches in two manholes near the upstream end of the Dixie trunk sewer. The project is included in the RMP but work will be performed by LFUCG as part of their annual rehabilitation/asset renewal program. Capital costs for this project are not reflected in Table 3-1 or Section 5.

7. Expansion Area 2A Projects - LFUCG is currently underway with projects to construct an 11 MGD pump station and approximately 4,200 linear feet of 24-inch force main discharging to the North Elkhorn Pump Station. The project also consists of a new force main for the Hamburg Farm Pump Station which will divert flow to the new EA2A infrastructure, and the construction of several short gravity sewers to eliminate four smaller pump stations including Man o' War, Gleneagles, Blackford, and Greenbriar 1 pump stations.

Estimated Remedial Measures Plan Costs

A capital cost summary of recommended Remedial Measures Plan improvements is presented in Table 3-1. Capital costs in the table include costs for preliminary study, land acquisition, design, inspection, administration, contingency, and legal/finance, based on the percentages outlined in Section 2E.

Table 3-1: Proposed RMP Improvements and Capital Cost – North Elkhorn

| Sewershed | North Elkhorn |
|---|----------------|
| Pipelines – new or replaced | 17,000 LF |
| EQ Basin/tank location(s) | 1 |
| EQ Basin/tank volume | 2.2 MG |
| Total Capital Cost for Remedial Measures Plan – North Elkhorn | \$16.3 Million |

The total estimated capital cost to implement the North Elkhorn detailed solution is approximately \$16.3 million. This cost does not include capital costs for collection system rehabilitation in the Floyd Drive area upstream of the Dixie Trunk Sewer necessary to reduce I/I and avoid trunk sewer replacement.

A detailed summary of the capital costs for proposed individual RMP projects in the North Elkhorn sewershed, along with a preliminary schedule for completion, is presented in Section 5.

Sewer Surcharged Conditions

Proposed RMP improvement projects were developed to eliminate SSOs for a 2-year level of control. Consideration was given, to the extent practical, to eliminate sewer surcharged conditions (as defined in Section VII.16.B of the Consent Decree) as well. Sewer surcharging was evaluated with the hydraulic model. Upon completion of the proposed RMP projects, nearly all of the trunk sewers in the North Elkhorn sewershed will not exhibit surcharged conditions for the 2-year, 24-hour storm event. Figure 3-5 illustrates those areas within the North Elkhorn sewershed that will experience sewer surcharging for the 2-year, 24-hour storm event. The surcharged sewers shown in the figure generally occurred in areas where there is limited opportunity for upstream growth and redevelopment to a higher population density is not anticipated. Each of the surcharge areas identified in Figure 3-5 are summarized below.

1. **Eastland Trunk Sewer (twelve manholes between NE2_23 to NE2_31).** The Eastland Trunk Sewer exhibits surcharging in excess of 24 inches above the pipe crown for the design storm. Additionally, the downstream-most surcharged manhole (NE2_23) surcharges less than 24 inches, but is surcharged within 36 inches of the manhole rim. A reduction in wet weather flows is anticipated that will reduce/eliminate sewer surcharging. Additional development upstream of these manholes is not anticipated.
2. **Manhole NE3_157A just upstream of the Dixie Pump Station.** The manhole located just upstream of the new Dixie Pump Station exhibits surcharging in excess of 24 inches above the pipe crown for the design storm. A reduction in wet weather flows is anticipated in this area that will reduce/eliminate sewer surcharging. Additional development upstream of these manholes is not anticipated.

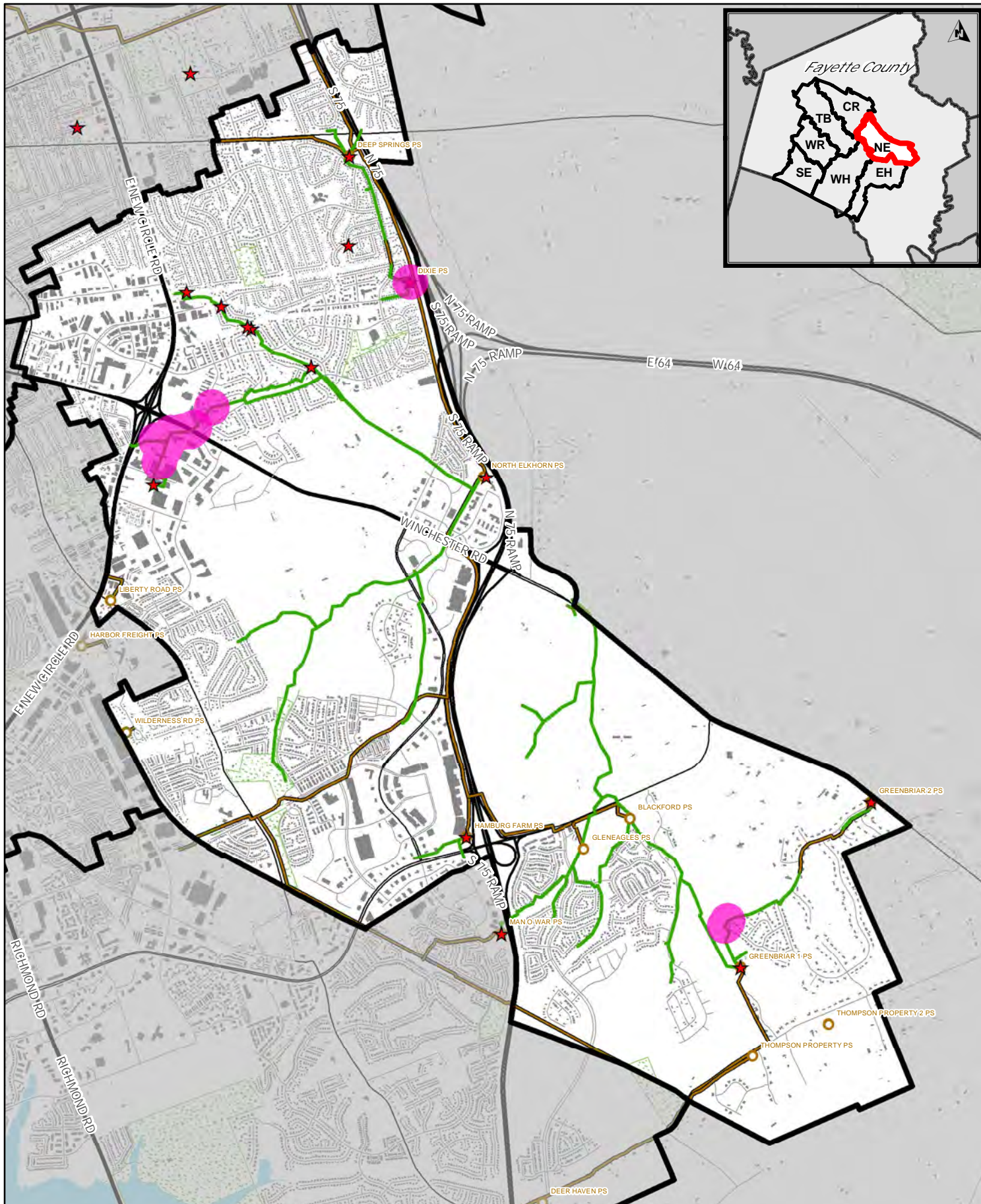


Figure:

3 - 5



1" = 3,300'

CAP Violation Areas - North Elkhorn

Manholes that Violate CAP Surcharge Criteria During a 2-year Storm with Proposed Remedial Measures in Place



Appendix A SSO



Major Sewershed



Existing Pump Station



Modeled Gravity Sewer



Existing Force Main



3. **Greenbriar Trunk Sewer (manhole NE5_79 and NE5_80).** Sewer surcharging less than 24 inches but within 36 inches of the manhole rim occurs at two manholes on this sewer for the design storm. A reduction in wet weather flows is anticipated in this area that will reduce/eliminate sewer surcharging. Additional development upstream of these manholes is not anticipated.

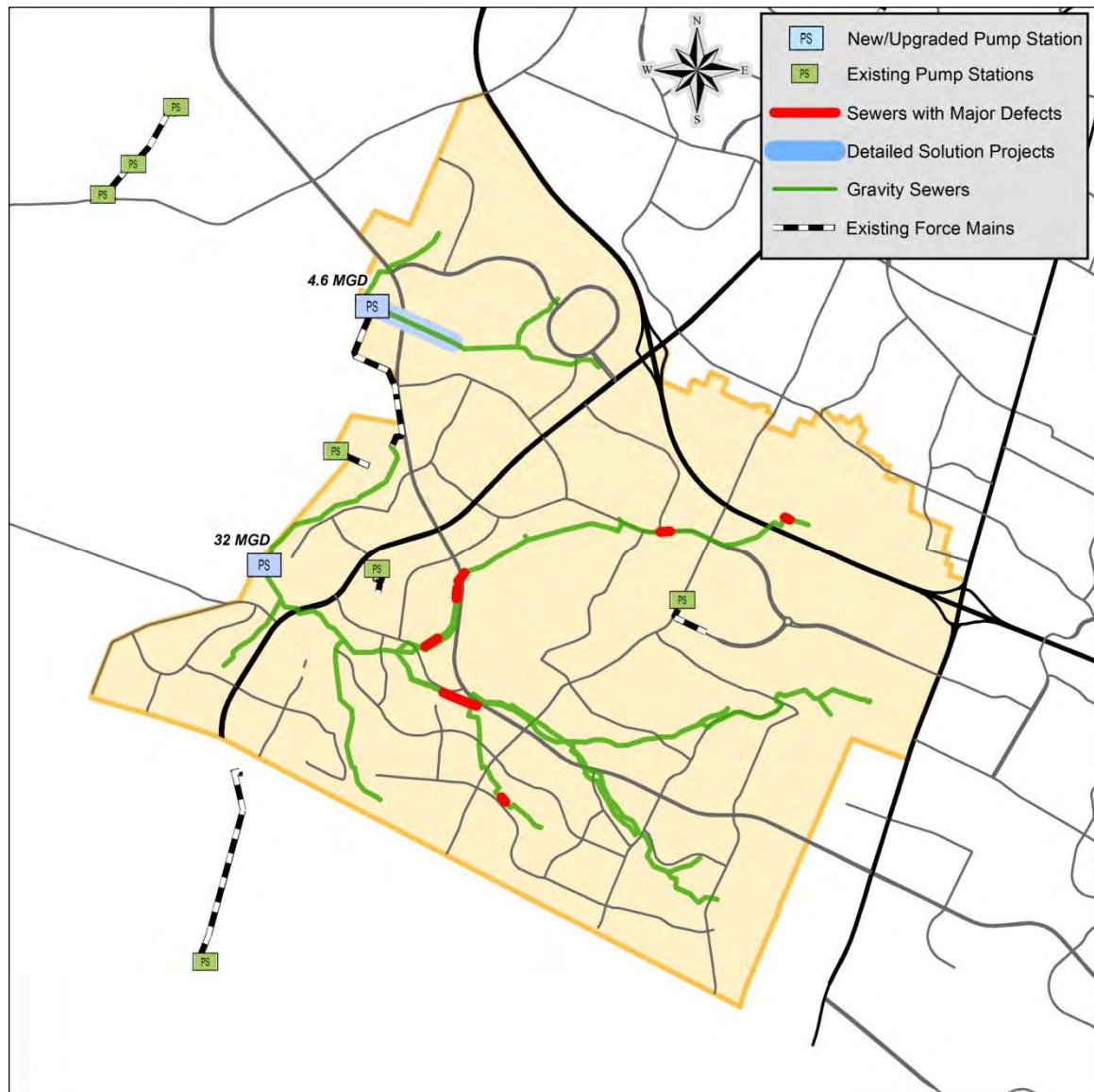
2) South Elkhorn Sewershed Detailed Solutions

Trunk Sewer Condition

CCTV inspection was performed during SSA field activities on approximately 29 percent of the sewers in the South Elkhorn sewershed. In areas where CCTV inspection was not performed during SSA field activities, CCTV inspection information collected during the 1998 – 2001 Sewer Trunk Studies was used. Sewer condition information from both CCTV efforts was reviewed and used to identify major structural defects within the modeled trunk sewers. Major structural defects were defined as those with a Grade of 4 or 5 according to the Pipeline Assessment Certification Program (PACP). Pipe deformation in high-density polyethylene (HDPE) or polyvinyl chloride (PVC) pipes were omitted from the major defects category. CCTV performed during the 1998-2001 Trunk Studies was not coded to PACP. CCTV logs from these activities were reviewed manually and defects with an equivalent PACP Grade 4 or 5 were identified.

CCTV inspection information was used to gain a general understanding of sewer condition. Sewer condition was considered in decision-making between competing RMP improvement alternatives. For example, when a localized storage tank or relief sewer was considered to avoid upsizing downstream trunk sewers, the condition of the downstream sewer was reviewed. If the downstream sewer was in need of replacement, then it was sized for the design flow and the need for the storage tank or relief sewer was eliminated.

A map showing proposed South Elkhorn conveyance improvements in the recommended Remedial Measures Plan and trunk sewer condition is presented in Figure 3-6. Sewers identified with major defects that will not be replaced by RMP conveyance improvements will be addressed by LFUCG as part of the annual rehabilitation/asset renewal activities outlined in their Capacity, Management, Operation and Maintenance (CMOM) program.

Figure 3-6: Trunk Sewer Condition with Detailed Solution – South Elkhorn**Recommended RMP Improvements**

Based on flow contributions summarized in Section 3 (B)(2), the following is a summary of the proposed RMP improvements in the South Elkhorn Sewershed.

1. Add Pump at South Elkhorn Pump Station - In September 2010, LFUCG completed the South Elkhorn Pump Station and Force Main Project. The new pump station's peak capacity is approximately 29 MGD with all five pumps operating. During the replacement, the station was configured to allow for the addition of a sixth pump. The RMP improvements include the addition of this pump to bring the peak pump station capacity up to approximately 32 MGD. No improvements are anticipated to be necessary to the existing force main.

2. Upgrade Mint Lane Pump Station - The Mint Lane Pump Station has experienced significant maintenance and reliability issues resulting in the pump station not operating at full capacity. The RMP improvements include pump replacement and/or maintenance upgrades to achieve a peak pump station capacity of approximately 4.6 MGD. No improvements are anticipated to be necessary to the existing force main.

3. Mint Lane Trunk - Upsize/replacement of 2,455 linear feet of existing 15-inch trunk sewer to 18-inch diameter.

Estimated Remedial Measures Plan Costs

A capital cost summary of recommended Remedial Measures Plan improvements is presented in Table 3-2. Capital costs in the table include costs for preliminary study, land acquisition, design, inspection, administration, contingency, and legal/finance, based on the percentages outlined in Section 2E.

Table 3-2: Proposed RMP Improvements and Capital Cost – South Elkhorn

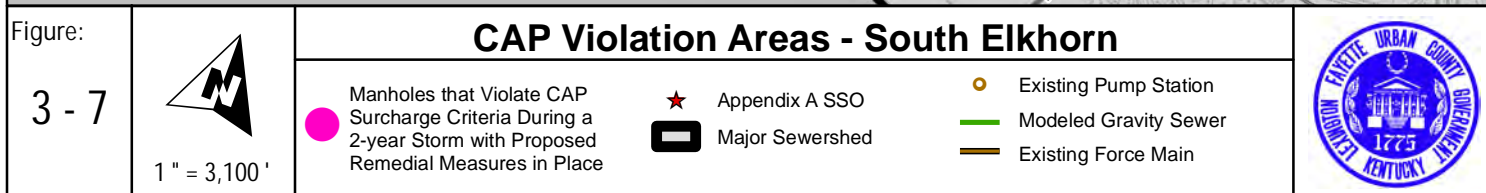
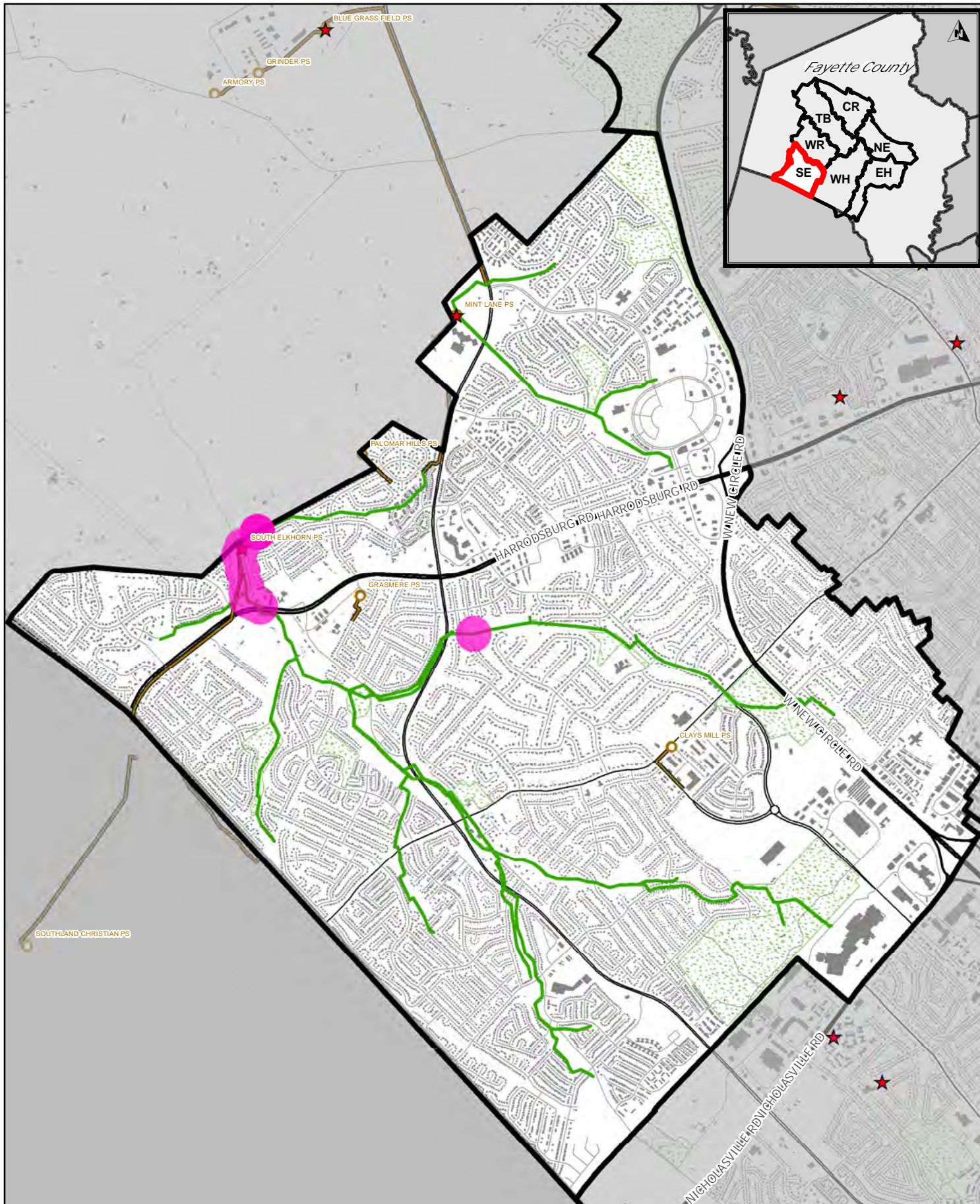
| Sewershed | South Elkhorn |
|---|---------------|
| Pipelines – new or replaced | 2,000 LF |
| EQ Basin/tank location(s) | - |
| EQ Basin/tank volume | - |
| Total Capital Cost for Remedial Measures Plan – South Elkhorn | \$6.4 Million |

The total estimated capital cost to implement the South Elkhorn detailed solution is approximately \$6.4 million.

A detailed summary of capital costs for proposed individual RMP projects in the South Elkhorn sewershed, along with a preliminary schedule for completion, is presented in Section 5.

Sewer Surcharged Conditions

Proposed RMP improvement projects were developed to eliminate Recurring SSOs for a 2-year level of control. Consideration was given, to the extent practical, to eliminating sewer surcharged conditions (as defined in Section VII.16.B of the Consent Decree) as well. Sewer surcharging was evaluated with the hydraulic model. With the implementation of the proposed RMP projects, nearly all of the trunk sewers in the South Elkhorn sewershed will not exhibit surcharged conditions for the 2-year, 24-hour storm event. Figure 3-7 illustrates those areas within the South Elkhorn sewershed that will experience sewer surcharging for the 2-year, 24-hour storm event. The surcharged sewers shown in the figure generally occurred in areas where there is limited opportunity for upstream growth and redevelopment to a higher population density is not anticipated. Each of the surcharge areas identified in Figure 3-7 are summarized in the following paragraphs.



Just Upstream of the South Elkhorn Pump Station (eight manholes between SE1_5009 and SE1_6253 and manhole SE1_6516). The South Elkhorn trunk sewer exhibits sewer surcharging greater than 24 inches above the pipe crown at eight manholes. The Palomar trunk sewer (entering the South Elkhorn Pump Station from the north) exhibits sewer surcharging greater than 24 inches above the pipe crown and within 3 feet of the manhole rim at one manhole. Based on the modeling, surcharging is the result of backwater from the South Elkhorn Pump Station. LFUCG intends to perform I/I reduction activities in the South Elkhorn sewershed as part of the programmatic rehabilitation. These efforts are anticipated to reduce/eliminate sewer surcharging.

1. **Manhole SE2_6141 on the Stonewall Trunk.** The Stonewall trunk sewer exhibits sewer surcharging less than 24 inches above the pipe crown, but within 3 feet of the manhole rim at one shallow manhole (4.2 feet deep) just upstream of Man o' War Boulevard. Additional development upstream of this manhole is not anticipated.

D. Cross Connections

There are no cross connections between the sanitary and storm sewer systems in the Group Three sewersheds identified in Appendix A or Appendix F of the Consent Decree. No cross connections were identified in Group Three sewersheds during SSA field activities.

E. Pump Station Reliability and Capacity Upgrades

To satisfy the requirements of Section VII(15)(C) of the CD, LFUCG completed a Pumping Station Design, Capacity, and Equipment Condition Adequacy Evaluation for the pump stations listed in Appendix H of the CD. It should be noted that Deep Springs, Dixie, North Elkhorn, and South Elkhorn pump stations were not evaluated because they have recently been replaced in accordance with the "Capital Improvement Projects and Short Term SSO Measures" outlined in Section VII(15)(A) of the Consent Decree. Pump stations in the Group Three sewersheds included in the Adequacy Evaluation included:

- Bluegrass Field Pump Station
- Greenbriar 1 Pump Station
- Greenbriar 2 Pump Station
- Hamburg Farm Pump Station
- Man o' War Pump Station
- Mint Lane Pump Station

Two (2) of these pump stations (Greenbriar 1 and Man o' War) will be eliminated as part of the Expansion Area 2A projects currently underway and therefore do not require reliability upgrades. The Bluegrass Field Pump Station and Force Main was replaced prior to 2011. The Greenbriar 2 Pump Station will be replaced as part of the RMP improvements. The Hamburg Farm Pump Station has experienced frequent mechanical and electrical failures. New pumps were installed January 24, 2012 and reliability upgrades are being considered. RMP improvements include upgrading the Mint Lane Pump Station to improve reliability and peak capacity.

LFUCG has evaluated pump station reliability in accordance with Section VII(16)(E) in their Sanitary Sewer Pumping Station Operation Plan for Power Outage. Any recommended pump station improvements from this plan will be implemented by LFUCG separate from the RMP implementation and are not included in the RMP projects summarized in Section 5 of this report.

F. Group Three Detailed Solutions Summary

Table 3-3 below summarizes the preferred solutions and associated costs for each sewershed.

Table 3-3: Detailed Solutions Summary

| Item | Quantities | |
|---------------------------|-----------------------|----------------------|
| | North Elkhorn | South Elkhorn |
| ≤15" | 5,124 LF | 0 LF |
| 18"-24" | 5,014 LF | 2,455 LF |
| 27"-36" | 57 LF | 0 LF |
| 42"-54" | 52 LF | 0 LF |
| Force Main | 6,968 LF | 0 LF |
| Subtotal Pipe | 17,215 LF | 2,455 LF |
| PS Improvements | 12.8 MGD | 11.8 MGD |
| EQ | 2.2 MG | 0 MG |
| Total Capital Cost | \$16.3 Million | \$6.4 Million |

Section 4 Inflow/Infiltration (I/I) Program Strategy and Prioritization

A. Background

Flow monitoring was performed in the Group Three sewersheds as part of the Capacity Assessment and the Sanitary Sewer Assessment (SSA) to fulfill the requirements in Paragraph VII.15.B(vi) of the Consent Decree. Flow monitoring locations were selected to quantify the wet weather response from the collection system and identify those areas with excessive inflow and infiltration.

SSA flow monitoring was performed for a four (4) month period from February 2, 2010 to June 2, 2010. A total of 49 fixed location meters were installed in the Group Three sewersheds.

Monitoring locations were selected, to the extent practical, to provide complete coverage of the collection system, encompass a minimum upstream collection system length of 10,000 linear feet, and concentrate meters in areas upstream of known sanitary sewer overflows (SSOs) and areas where previous Capacity Assessment flow monitoring (Spring 2009) indicated a significant wet weather response.

Hydraulic models of the trunk sewers in the Group Three sewersheds were developed and calibrated in accordance with the requirements outlined in Paragraph VII.15.E(i) of the Consent Decree. The models identify hydraulic performance of the trunk sewer system for the 2-year, 24-hour storm under both existing and future development conditions.

Flow monitoring results from the 2010 monitoring period, as well as a summary of the hydraulic modeling results were published in a report entitled Group Three Sanitary Sewer System Assessment Report, dated April 12, 2012. This report was submitted to the EPA per the requirements outlined in Paragraph VII.15.F of the Consent Decree.

B. Wet Weather Response Prioritization

Inflow and infiltration (I/I) reduction through sewer rehabilitation provides a means of restoring wet weather capacity in sanitary sewer systems. Prioritization of areas within the collection system is necessary to focus rehabilitation efforts where I/I removal benefits will be maximized and capital expenditures will be most cost-effective.

Prioritization of collection system areas in the Group Three sewersheds was performed based on the wet weather response observed during the 2010 flow monitoring period. A summary of the flow monitoring locations and their contributing collection system areas (metersheds) utilized in the 2010 monitoring period was presented in the Group 3 Sanitary Sewer System Assessment Report, submitted on April 12, 2012.

General priorities were established for each of the metersheds from the 2010 flow monitoring. Metersheds were assigned a priority of High, Medium, or Low. Priorities were assigned based on:

- Magnitude of the difference between the dry weather and wet weather peak flows
- Volume of rainfall dependent inflow and infiltration (RDII)
- Proximity to known sanitary sewer overflows (SSOs)

C. Level of Control Prioritization

The Sanitary Sewer System and WWTP Remedial Measures Plan (RMP) identify those capital projects and system improvements that are necessary to address capacity issues within the Group Three sewersheds for a 2-year level of control. The occurrence of wet weather events in excess of the selected level of control may result in SSOs within the system.

To minimize the potential for SSOs resulting from wet weather events in excess of the selected level of control, collection system rehabilitation can be prioritized based on their proximity to potential SSO locations. I/I removal in these areas can be effective at increasing the level of control in these areas and reducing the incidence of non-recurring wet weather SSOs.

The hydraulic models for the Group Three sewersheds were used to predict SSO locations for a rainfall event with a 5-year return interval and assuming that all conveyance and storage improvement projects identified in the RMP have been constructed. A graphical summary of the SSO locations predicted by the hydraulic model under these two conditions (and assuming the future growth condition) is presented in Figure 4-1 and 4-2 for North Elkhorn and South Elkhorn, respectively.

Five (5) SSO clusters were predicted in the Group Three sewersheds resulting from the occurrence of a 5-year rainfall event for the future (2035) conditions and with the assumption that all conveyance and storage improvements (designed for a 2-year level of control) were in place. An SSO cluster was predicted at each sewershed outlet - one SSO cluster at the proposed equalization basin/storage tank at the North Elkhorn Pump Station, and the other at the South Elkhorn Pump Station. The remaining three (3) SSO clusters occur at manholes within the conveyance system, with two occurring at shallow (less than five feet deep) manholes in the North Elkhorn sewershed and the other in the South Elkhorn sewershed just upstream of the Mint Lane Pump Station.

Prioritization of collection system rehabilitation by level of control yields three collection system areas upstream of the manhole SSO clusters where I/I removal could be effective at eliminating a potential SSO resulting from rainfall events in excess of the selected 2-year level of control. The three areas were selected as those areas upstream of the model predicted SSOs that occurred in the conveyance system during a 5-year storm. Predicted SSOs at the storage tank adjacent to the North Elkhorn Pump Station and at the South Elkhorn Pump Station were not included in the proposed rehabilitation because the areas upstream of these SSOs encompass too large a portion of the collection system to be considered useful for prioritization.

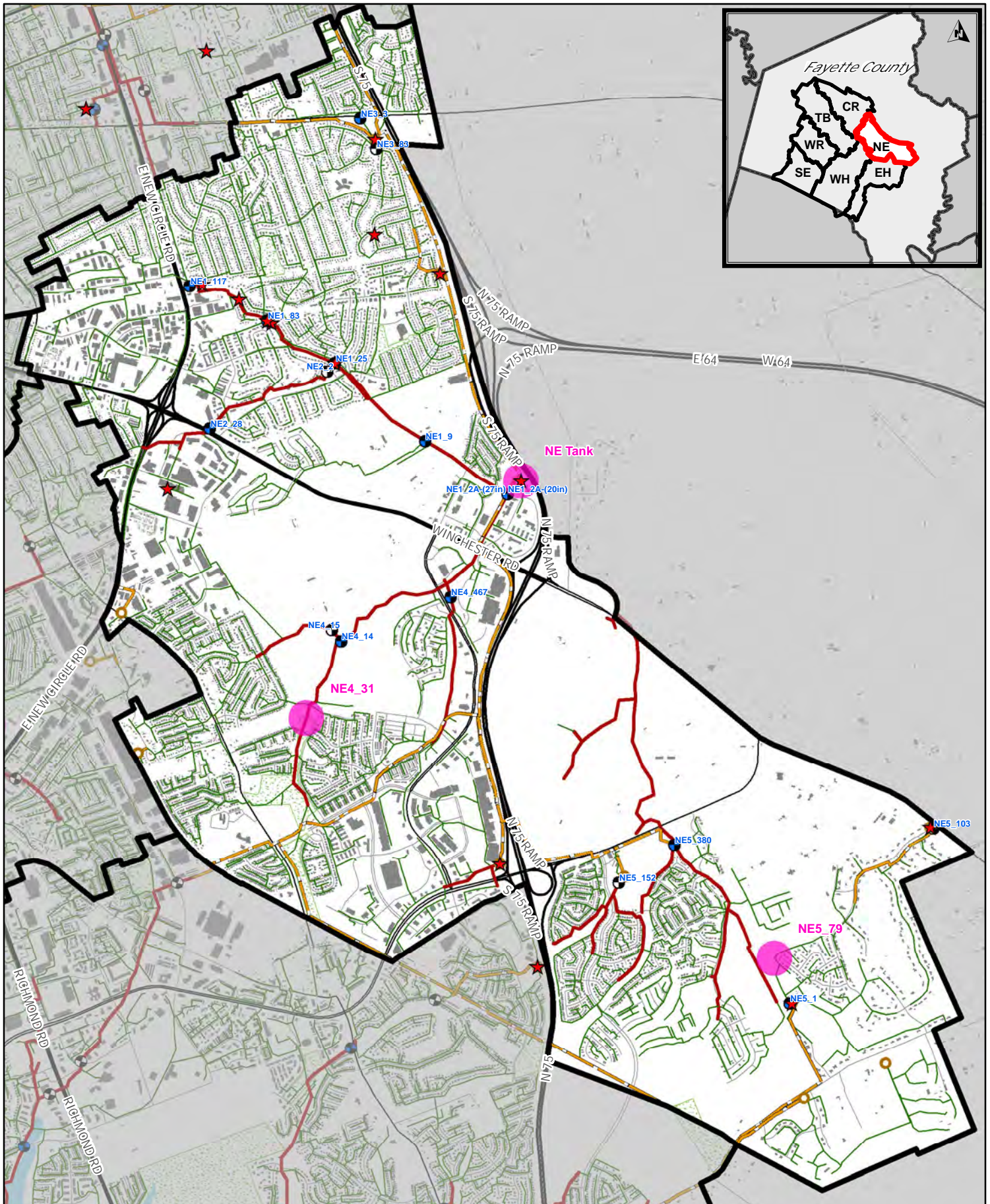


Figure:

4 - 1



1" = 3,100'

SSOs for 5-year Storm and 2-year LOS - North Elkhorn

Model Predicted SSO Locations for 5-year Rainfall Event with 2-year Level of Service Remedial Measures Plan

Flow Meter

Flow/Groundwater Meter

Appendix A SSO



Pump Station



Collector Sewer (< 12" Diam.)



Force Main



Trunk Sewer (>= 12" Diam.)



Major Sewershed



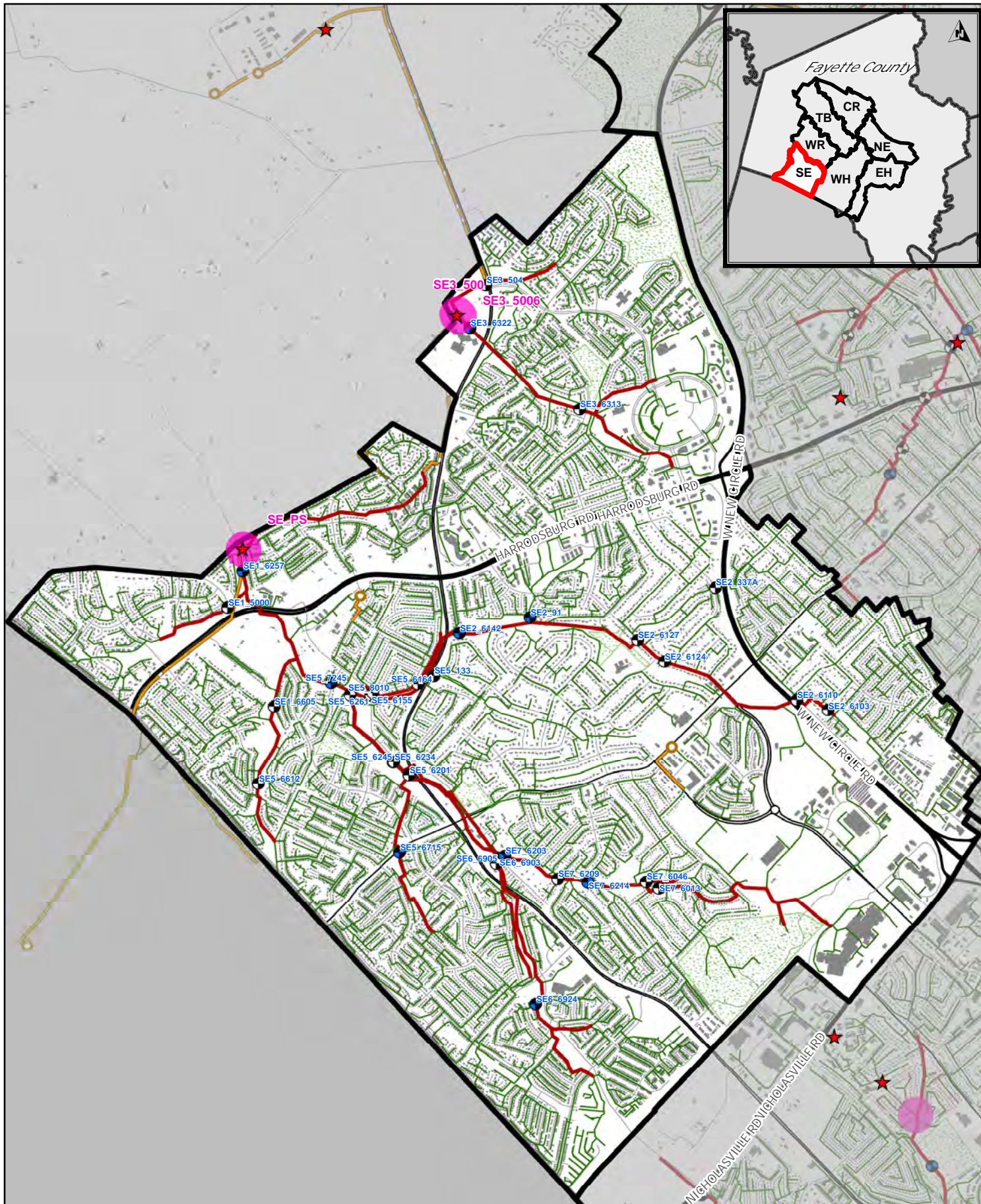


Figure:

4 - 2



1" = 3,100'

SSOs for 5-year Storm and 2-year LOS - South Elkhorn

Model Predicted SSO Locations
for 5-year Rainfall Event with
2-year Level of Service
Remedial Measures Plan

Flow Meter

Flow/Groundwater Meter

Appendix A SSO

Pump Station

Collector Sewer (< 12" Diam.)

Force Main

Trunk Sewer (>= 12" Diam.)

Major Sewershed



D. Strategy

Determining the effectiveness of proposed collection system rehabilitation at reducing the wet weather response in the system is uncertain. Historically achieved I/I removal rates vary widely, both locally and across the nation. Reliance on a prescribed I/I removal effectiveness when sizing conveyance and storage improvements presents an inherent risk. If targeted I/I reductions are not achieved, conveyance and storage improvements will be too small to restore adequate wet weather capacity in the system.

In order to ensure an achievable level of control from implementation of the Remedial Measures Plan in the Group Three sewersheds, I/I removal within the collection system was not considered when sizing conveyance and storage improvements. Conveyance and storage improvements were designed to completely restore adequate capacity in the system for the 2-year, 24-hour rainfall event with no assumed I/I reduction in the collection system.

LFUCG intends to aggressively pursue collection system rehabilitation on a programmatic basis concurrent with implementation of the conveyance and storage improvements outlined in the RMP. Beginning in FY2013, LFUCG increased their annual budget for collection system rehabilitation from \$1.5 million to \$5 million and intends to maintain this funding level over the life of the RMP implementation.

An extensive amount of field inspections in the wastewater collection system in the Group Three sewersheds was conducted as part of the SSA field activities. Field activities included closed circuit television (CCTV) inspection of approximately 320,000 linear feet of sewer pipe; over 2,300 manhole inspections; and smoke testing of approximately 1,190,000 linear feet of sewer pipe. Collected defect information on the sewer system's condition will be used by LFUCG to develop rehabilitation recommendations in prioritized collection system areas. Additional sewer inspection information collected by LFUCG as part of their Gravity Line Preventative Maintenance Program (GLPMP) efforts will also be considered when developing rehabilitation recommendations.

Flow monitoring was also performed as part of the SSA to aid in identifying the wet weather I/I contribution within the collection system areas of the Group Three sewersheds. Wet weather response data will be used by LFUCG to identify opportunities for private property I/I removal.

In February 2012, LFUCG passed an ordinance (#13-2012, Article VIII, Chapter 16) that provides LFUCG with the statutory authority to inspect private property for improper connections and stormwater sources to the sanitary sewer system. The ordinance also allows LFUCG to levy financial penalties to customers who refuse the inspection or fail to disconnect improper connections. The resolution will allow LFUCG to take a more comprehensive approach to removing I/I in targeted collection system areas.

The wet weather and level of control prioritizations outlined above in Sections 4B and 4C will be used as the basis for prioritizing LFUCG's programmatic collection system rehabilitation efforts. The results of these efforts will very likely yield an increase in level of control for Remedial Measures improvements above that of a two-year design storm. LFUCG is currently undergoing an I/I masterplan effort to prioritize rehabilitation areas citywide based on the strategy discussed above.

Section 5 Prioritization and Schedule

A. Prioritization Process

1) Project Prioritization Process Overview

The Group Three Sanitary Sewer System and WWTP Remedial Measures Plan consists of projects to address capacity issues within the Group Three sewersheds. These projects will provide improvements to the sanitary sewer system and result in the elimination of recurring SSOs, wet-weather unpermitted bypasses at the WWTPs, and recurring NPDES permit violations related to excess flow for a 2-year, 24-hour storm.

The development of the RMP is being done in accordance with the requirements of Paragraph VII.15.G of the Consent Decree. Specifically, Paragraph VII.15.G(vi) identifies criteria to prioritize the sanitary sewer system remedial measures as follows:

- a) Relative likely human health and environmental impact risks
- b) Recurring SSO frequencies of activation
- c) Total annual recurring SSO volumes
- d) May also take into account cost-effectiveness and risks associated with implementation

The task of prioritizing the Group Three RMP projects and developing a detailed implementation plan was conducted in a four-step process described below. This process was designed to comply with the requirements of the CD and fit within LFUCG's estimated annual capital expenditure budget and related programs.

2) Prioritization Methodology

The prioritization of the RMP in **Step 1** incorporates many factors into the methodology of determining priority and schedule. These factors include:

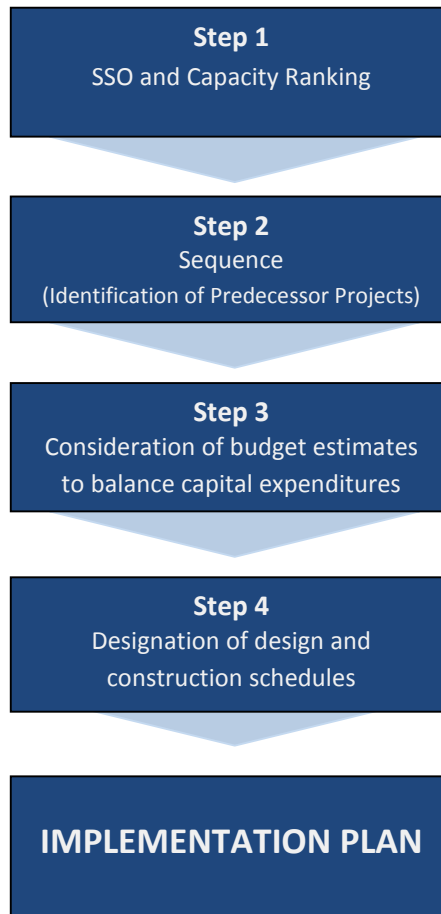
- Frequency and volume of SSOs
- Capacity restrictions in the collection system
- Logical sequence (necessary predecessor projects)
- Cash flow (balancing capital costs with annual expenditure budgets)

A prioritization methodology chart is provided to illustrate the process in Figure 5-1. SSOs (identified in Appendix A of the Consent Decree and/or shown by the hydraulic model as surcharging or overflowing during a 2-year, 24-hour storm) were grouped into clusters with other SSOs in close proximity. Proposed capital projects were developed that addressed each cluster and individual wet-weather SSO. The hydraulic model results provided information related to the frequency and volume of SSOs for each cluster. A database was created and populated with the following information:

- Total number of SSOs in each cluster
- Total number of Appendix A SSOs in each cluster
- Total volume overflowed during the 2-year storm

- Frequency of overflows in a 2-year period (i.e. an SSO estimated to occur during a 6-month storm would have a 2-year frequency of 4, whereas an SSO estimated to overflow only during a 5-year storm would have a frequency of 0.4)
- Subject project (the specific project that would eliminate the Recurring SSO cluster)
- Predecessor projects, generally downstream of the subject project

Figure 5-1: Prioritization and Implementation Methodology



Each cluster was ranked first by frequency, then by the sum of the rankings for total volume, total SSOs, and Appendix A SSOs. The resulting list consisted of the Step 1 rankings. The highest priority projects involve the elimination of frequent and high-volume SSOs; the lowest priority projects do not eliminate SSOs, but increase collection system capacity such that surcharging is eliminated in the 2-year storm. The SSO cluster prioritizations/rankings are provided in Table 5-1. Maps identifying the SSO clusters are presented in Figures 5-2 and 5-3.

Table 5-1. Group Three SSO Cluster Prioritization

| Cumulative Priority | Cluster Name | 2-year Frequency | Total 2-year SSO Volume (MG) | No. of Model-Predicted 2-year SSOs | No. of Appendix A SSOs | Cluster Ranking By SSO Volume | Cluster Ranking By No. of Model-Predicted SSOs | Cluster Ranking By No. of Appendix A SSOs | Sum of Cluster Rankings | Subject Project for SSO Cluster Disposition | Predecessor Projects |
|---------------------|--------------|------------------|------------------------------|------------------------------------|------------------------|-------------------------------|--|---|-------------------------|---|----------------------|
| 1 | PS_GB1 | 4.0 | 0.415 | 1 | 1 | 1 | 2 | 1 | 4 | NE 8 | -- |
| 2 | PS_SE | 1.0 | 0.242 | 1 | 1 | 2 | 2 | 1 | 5 | SE 1 | -- |
| 3 | PS_GB2 | 4.0 | 0.024 | 1 | 1 | 5 | 2 | 1 | 8 | NE 6 | -- |
| 4 | NE5 | 4.0 | 0.117 | 3 | 0 | 3 | 1 | 4 | 8 | NE 5 | NE 8 |
| 5 | NE2_23 | 4.0 | 0.088 | 1 | 0 | 4 | 2 | 4 | 10 | NE 3 | NE 2 |
| 6 | SE3 | 0.4 | 0.000 | 0 | 0 | 6 | 6 | 4 | 16 | SE 2 | -- |

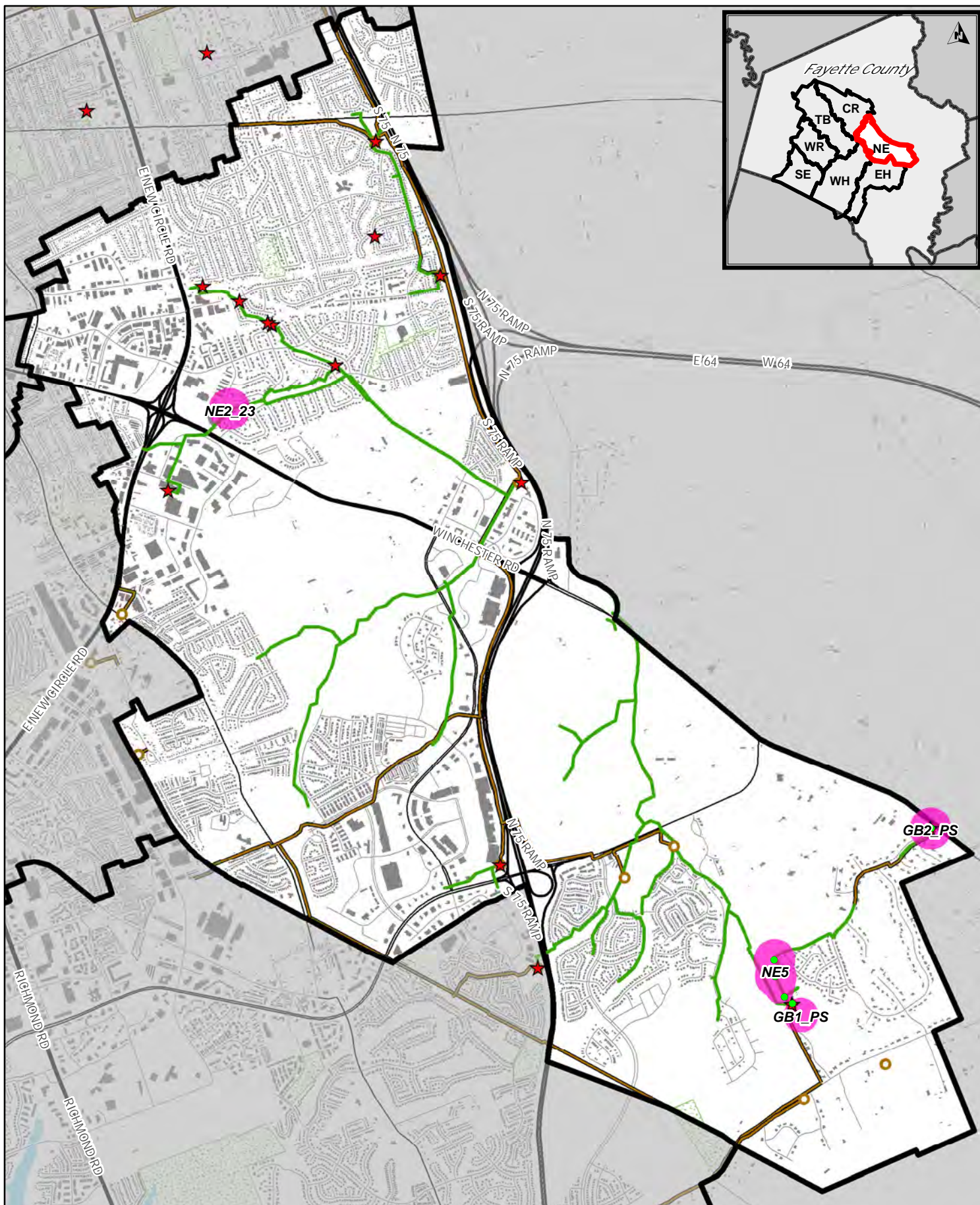


Figure:

5 - 2

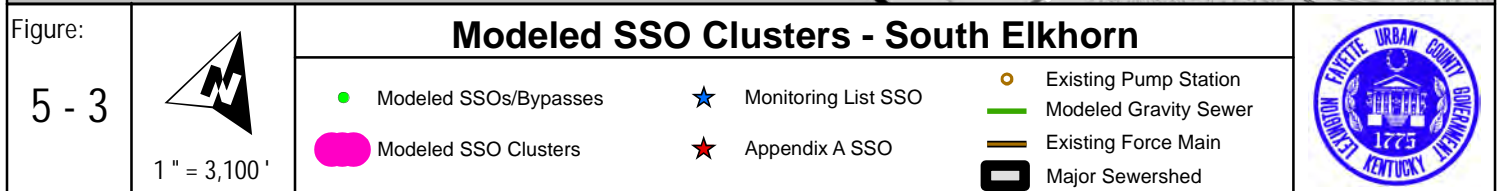
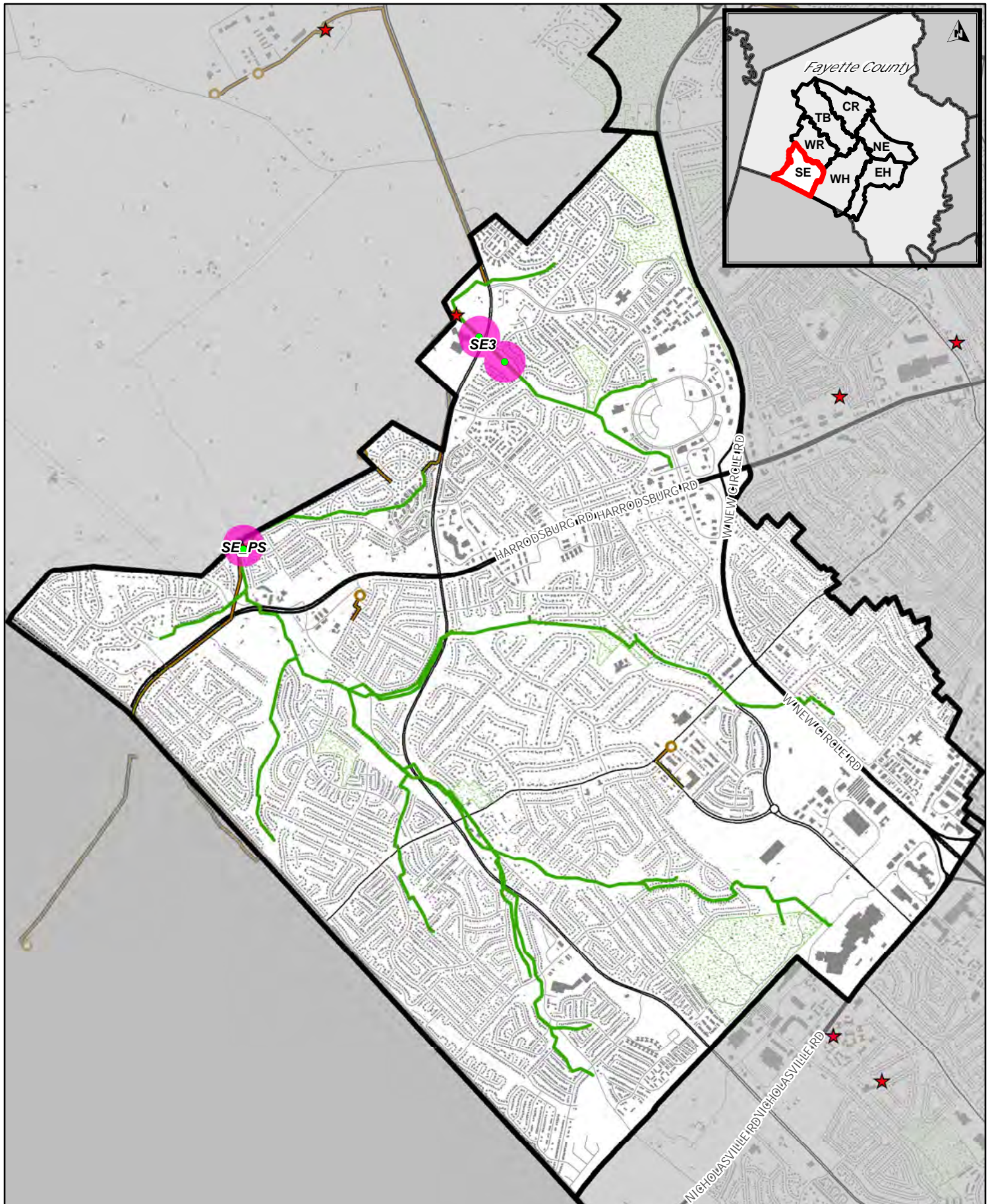


1" = 3,100'

Modeled SSO Clusters - North Elkhorn

- | | | |
|---|---|--|
| ● Modeled SSOs/Bypasses | ★ Monitoring List SSO | ○ Existing Pump Station |
| Modeled SSO Clusters | ★ Appendix A SSO | — Modeled Gravity Sewer |
| | | — Existing Force Main |
| | | Major Sewershed |





B. Implementation Plan Methodology

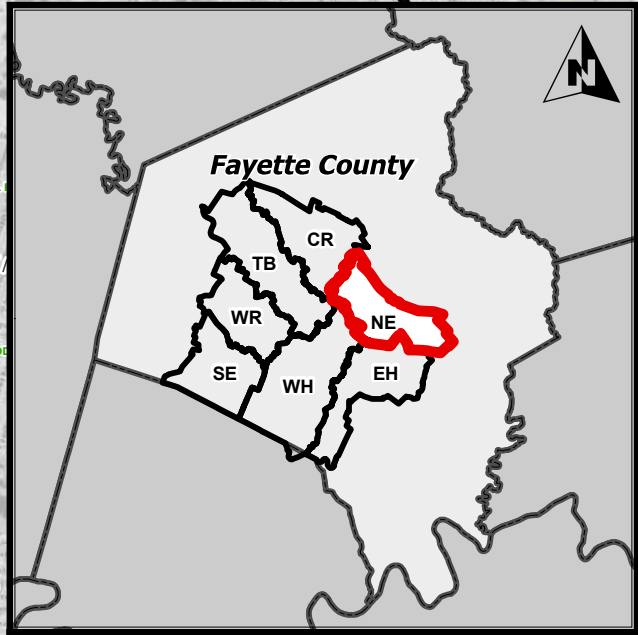
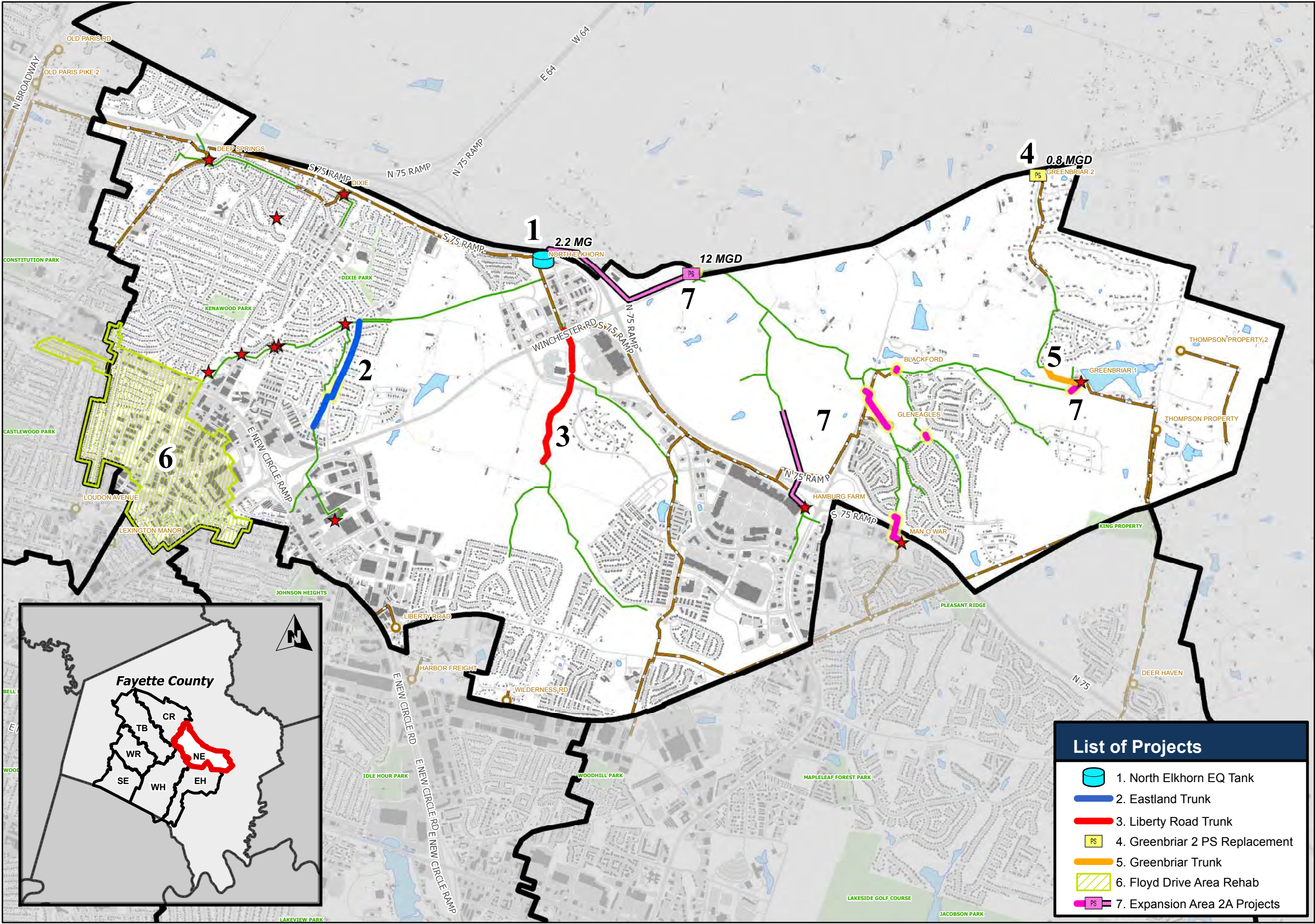
Once the projects were prioritized based on frequency, volume, and numbers of SSOs, **Step 2** consisted of sorting the projects according to logical sequence by considering the required predecessor projects. This consisted of identifying any projects which should be completed prior to initiating the subject project (i.e. adequate downstream conveyance is needed before upstream conveyance is increased or SSOs could be “relocated”). In the development of the implementation plan the predecessor projects were scheduled to occur before their subject projects.

In a separate exercise, LFUCG conducted a financial impact study based on initial RMP cost estimates for the entire sewer system. This financial study identified feasible annual rate increases, which were based on assumed annual expenditures. **Step 3** incorporated consideration of the resulting annual capital budgets in determining the appropriate timeframe for each improvement project. The ranked projects from Step 2 were distributed across the 13-year implementation period in a manner that balances capital expenditures with LFUCG budgeting to the extent practicable. While some early predecessor projects will not result in the elimination of SSOs, other early projects will address high-priority SSOs. Implementation of the RMP projects in accordance with this schedule will result in the elimination of all recurring SSOs as required by the Consent Decree.

Step 4 consisted of determining the specific schedule for the design and construction of each project. For the purpose of the RMP, design and construction phases ranged from one to two year durations in this Group Three set of projects. The developed implementation schedules are included in Figure 5-6, located at the end of this section. Overview maps that summarize the projects in each of the Group Three sewersheds are also located at the end of this section as Figures 5-4 and 5-5. The Implementation Plan includes projects from all three sewershed groups. Overview maps for the groups One and Two sewersheds can be found in their respective RMPs. Appendix 1 of this report includes Project Detail Sheets, which are one-page summaries for each project.

C. Incorporation of Remedial Measures for Group Three

The Implementation Plans developed for Group One (submitted in October 2011) and Group Two (submitted in April 2012), described in this document, have been reevaluated during the preparation of the Group Three RMP. Due to the inter-relationships between the sanitary sewer systems in different sewersheds, changes were made to the city-wide Sanitary Sewer System and WWTP Remedial Measures Plan during this Group Three RMP. Additional changes may be necessary during the execution of the RMP. LFUCG will begin following through on implementing the RMP while awaiting approval from USEPA.



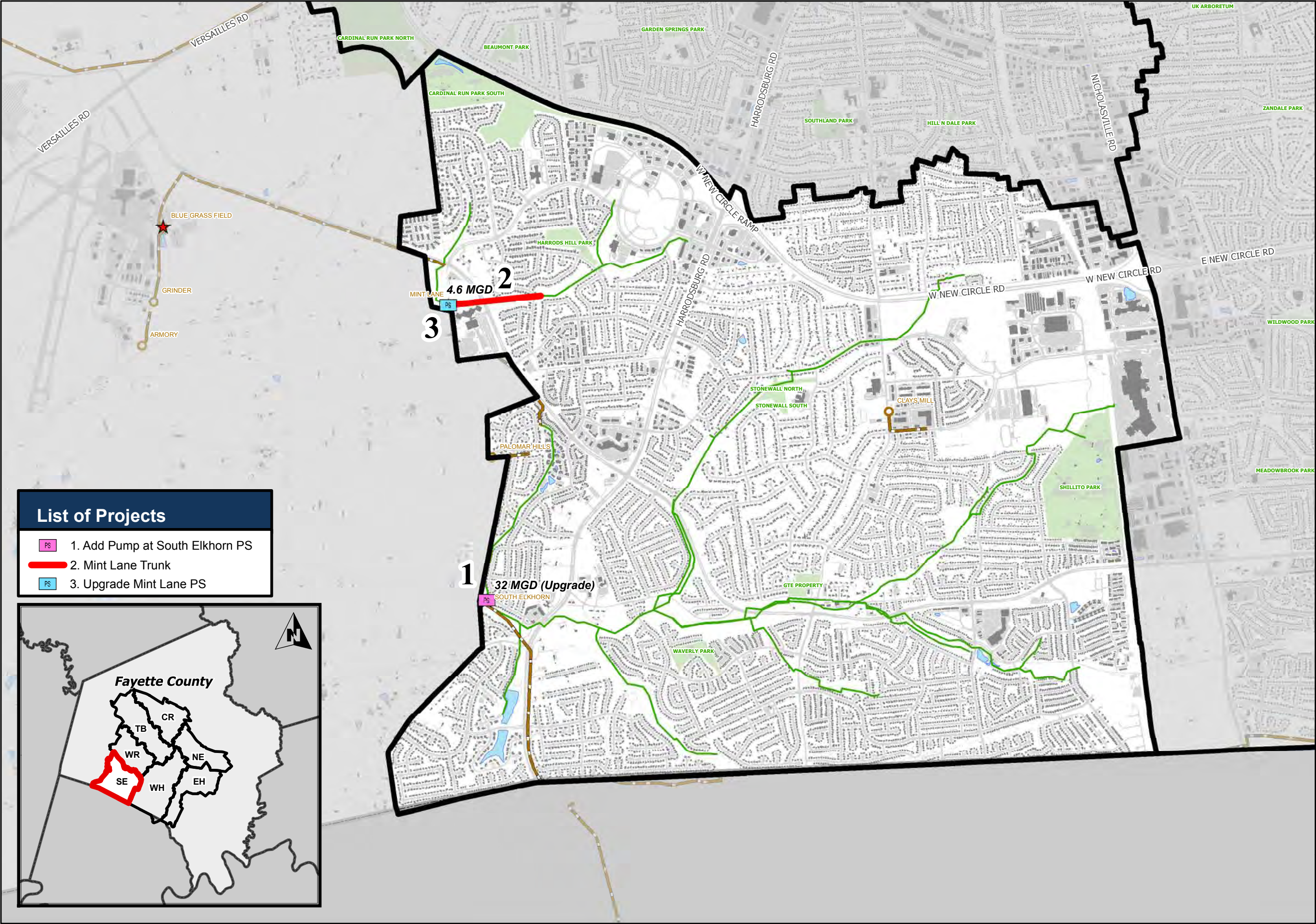
North Elkhorn Solution

| Proposed Remedial Measures (Different Colors Signify Separate "Projects") | | Monitoring List SSO | Appendix A SSO | Existing Pump Station | Existing Trunk Sewer | Existing Force Main | Major Sewershed |
|---|-----------------------|---------------------|----------------|-----------------------|----------------------|---------------------|-----------------|
| Upsize Existing Line | New Pump Station | ★ | ★ | ● | — | — | — |
| New Trunk Sewer | New Equalization Tank | — | — | — | — | — | — |
| New Force Main | — | — | — | — | — | — | — |

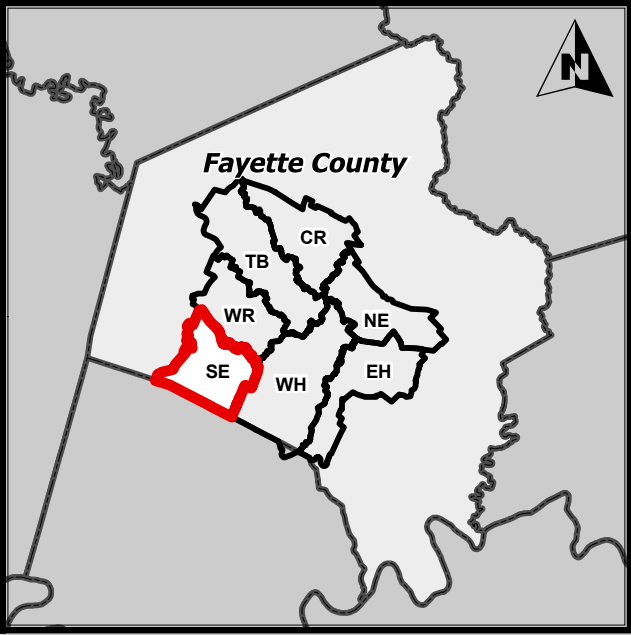
- List of Projects
- 1. North Elkhorn EQ Tank
 - 2. Eastland Trunk
 - 3. Liberty Road Trunk
 - 4. Greenbriar 2 PS Replacement
 - 5. Greenbriar Trunk
 - 6. Floyd Drive Area Rehab
 - 7. Expansion Area 2A Projects



1" = 2,400'

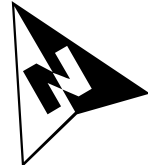


- List of Projects**
- PS 1. Add Pump at South Elkhorn PS
 - 2. Mint Lane Trunk
 - PS 3. Upgrade Mint Lane PS



South Elkhorn Solution

| Proposed Remedial Measures (Different Colors Signify Separate "Projects") | | Monitoring List SSO | Appendix A SSO | Existing Pump Station | Existing Trunk Sewer | Existing Foremain | Major Sewershed |
|---|-----------------------|---------------------|----------------|-----------------------|----------------------|-------------------|-----------------|
| Upsize Existing Line | New Pump Station | ★ | ★ | ● | — | — | — |
| New Trunk Sewer | New Equalization Tank | — | — | — | — | — | — |
| New Force Main | — | — | — | — | — | — | — |



1" = 2,400'

RMP Implementation Plan

10/12/2012

All cost estimates are provided in U.S. 2011 dollars.

This implementation schedule is measured from the date of EPA/EEC approval of all submitted Remedial Measures Plans.

| RMP Implementation Plan | | | | | | | | | | | | | | | | | DESIGN | | |
|---|--|---|-----------------------------------|----------------------------|--------------|--------------|--------------|--------------|--------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------------------------|----------------------------------|-----------|
| 10/12/2012 All cost estimates are provided in U.S. 2011 dollars. This implementation schedule is measured from the date of EPA/EEC approval of all submitted Remedial Measures Plans. | | | | | | | | | | | | | | | | | CONSTRUCTION | | |
| Sewer-shed | No. | Project Name | Design Cost Estimate ⁹ | Construction Cost Estimate | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 | Project Capital Cost Estimate | Project Annual O&M Cost Estimate | |
| East Hickman | 1 | East Hickman FM ¹ | \$860,000 | \$9,210,000 | | | | | | \$860,000 | \$4,605,000 | \$4,605,000 | | | | | \$10,070,000 | \$138,262 | |
| | 2 | East Hickman PS | \$1,190,000 | \$13,110,000 | | | | | \$595,000 | \$595,000 | \$6,555,000 | \$6,555,000 | | | | | \$14,300,000 | \$345,399 | |
| | 3 | East Hickman Equalization Tank | \$1,540,000 | \$16,520,000 | | | | | \$770,000 | \$770,000 | \$8,260,000 | \$8,260,000 | | | | | \$18,060,000 | \$248,418 | |
| | 4 | Overbrook Farm FM ¹ | \$120,000 | \$1,080,000 | | | | | | | | | | | \$120,000 | \$1,080,000 | \$1,200,000 | \$15,865 | |
| | 5 | Overbrook Farm PS ¹ | \$520,000 | \$5,300,000 | | | | | | | | | | \$520,000 | \$2,650,000 | \$2,650,000 | \$5,820,000 | \$138,676 | |
| | 6 | Overbrook Farm Trunk ¹ | \$420,000 | \$4,250,000 | | | | | | | | | | | \$420,000 | \$4,250,000 | \$4,670,000 | \$31,686 | |
| | 7 | Delong Road PS & FM ¹ | \$290,000 | \$2,840,000 | | | | | | | | | | \$290,000 | \$1,420,000 | \$1,420,000 | \$3,130,000 | \$69,927 | |
| | 8 | Armstrong Mill Trunks ¹ | \$100,000 | \$870,000 | | | | | | | | | | | \$100,000 | \$870,000 | \$970,000 | \$6,379 | |
| | 9 | Hartland 2 & 3 Trunks ¹ | \$170,000 | \$1,580,000 | | | | | | | | | | | | \$170,000 | \$1,580,000 | \$1,750,000 | \$11,633 |
| | 10 | Hartland 1 Trunk ¹ | \$120,000 | \$1,020,000 | | | | | | | | | | | | \$120,000 | \$1,020,000 | \$1,140,000 | \$7,458 |
| | 11 | Eliminate East Lake PS | \$70,000 | \$560,000 | | | | | | \$70,000 | | \$560,000 | | | | | | \$630,000 | \$4,031 |
| | 12 | Century Hills Trunk Upsize | \$150,000 | \$1,400,000 | | | \$150,000 | \$1,400,000 | | | | | | | | | | \$1,550,000 | \$10,322 |
| | 13 | East Lake Trunk Upsize | \$80,000 | \$700,000 | | | \$80,000 | \$700,000 | | | | | | | | | | \$780,000 | \$5,110 |
| | 14 | Autumn Ridge Trunk Upsize | \$100,000 | \$900,000 | | | | | | | | | | | | \$100,000 | \$900,000 | \$1,000,000 | \$6,591 |
| | 15 | Expansion Area #1 Property Acquisition ¹ | \$1,110,000 | \$- | | | | | | | | | \$1,110,000 | | | | | \$1,110,000 | \$0 |
| West Hickman | EH Totals = | | \$6,840,000 | \$59,340,000 | \$230,000 | \$2,100,000 | \$0 | \$0 | \$1,365,000 | \$2,295,000 | \$19,420,000 | \$21,090,000 | \$810,000 | \$4,710,000 | \$10,660,000 | \$3,500,000 | \$66,180,000 | \$1,039,757 | |
| | 1 | WH7 Equalization Tank | \$1,630,000 | \$17,460,000 | | | \$815,000 | \$815,000 | \$8,730,000 | \$8,730,000 | | | | | | | | \$19,090,000 | \$262,554 |
| | 2 | West Hickman Main Trunk A | \$380,000 | \$3,800,000 | | \$380,000 | \$3,800,000 | | | | | | | | | | | \$4,180,000 | \$28,335 |
| | 3 | West Hickman Main Trunk B | \$560,000 | \$5,780,000 | | | \$560,000 | | | | | | | | | | | \$6,340,000 | \$43,210 |
| | 4 | West Hickman Main Trunk C | \$440,000 | \$4,400,000 | | | \$440,000 | \$4,400,000 | | | | | | | | | | \$4,840,000 | \$32,845 |
| | 5 | Landsdowne South Trunk | \$330,000 | \$3,220,000 | | | | \$330,000 | \$3,220,000 | | | | | | | | | \$3,550,000 | \$23,978 |
| | 6 | West Hickman Main Trunk D | \$370,000 | \$3,660,000 | | | | \$370,000 | \$3,660,000 | | | | | | | | | \$4,030,000 | \$27,295 |
| | 7 | Merrick Trunk | \$360,000 | \$3,520,000 | | | | | \$360,000 | \$3,520,000 | | | | | | | | \$3,880,000 | \$26,225 |
| | 8 | Ecton Trunk | \$150,000 | \$1,400,000 | | | | | | \$150,000 | \$1,400,000 | | | | | | | \$1,550,000 | \$10,284 |
| | 9 | Southeastern Hills Trunk | \$210,000 | \$1,930,000 | | | | | | | | | | | | \$210,000 | \$1,930,000 | \$2,140,000 | \$14,275 |
| | 10 | West Hickman Main Trunk E | \$750,000 | \$7,950,000 | | | | | | | | \$750,000 | \$7,950,000 | | | | | \$8,700,000 | \$59,659 |
| | 11 | West Hickman Main Trunk F | \$450,000 | \$4,500,000 | | | | | | | | | \$450,000 | \$4,500,000 | | | | \$4,950,000 | \$33,601 |
| | 12 | Sutherland Trunk | \$180,000 | \$1,640,000 | | | | | | | | | \$180,000 | \$1,640,000 | | | | \$1,820,000 | \$6,787 |
| | 13 | Idle Hour Trunk | \$80,000 | \$700,000 | | | | | | | | | \$80,000 | \$700,000 | | | | \$780,000 | \$5,117 |
| | 14 | Centre Parkway Trunk | \$100,000 | \$850,000 | | | | | | | | | | \$100,000 | \$850,000 | | | \$950,000 | \$6,178 |
| | 15 | The Island Trunks | \$100,000 | \$890,000 | | | | | | | | | | | | \$100,000 | \$890,000 | \$990,000 | \$8,641 |
| | 16 | Woodhill Trunk | \$290,000 | \$2,790,000 | | \$290,000 | \$2,790,000 | | | | | | | | | | | \$3,080,000 | \$20,754 |
| | 17 | Prather Road Trunk | \$200,000 | \$1,870,000 | | | | | | | | | | | | \$200,000 | \$1,870,000 | \$2,070,000 | \$13,839 |
| | 18 | Richmond Road Trunk | \$170,000 | \$1,530,000 | | | | | | | | \$170,000 | \$1,530,000 | | | | | \$1,700,000 | \$11,271 |
| | 19 | Wildwood Park Trunk | \$110,000 | \$1,010,000 | | | | | | | | | | | | | | \$1,120,000 | \$7,402 |
| 20 | WH WWTP Equalization Tank ² | \$10,130,000 | \$108,610,000 | | | \$3,370,000 | \$3,380,000 | \$18,100,000 | \$18,100,000 | | \$3,380,000 | \$18,100,000 | \$18,100,000 | \$18,100,000 | \$18,100,000 | \$18,110,000 | \$118,740,000 | \$1,423,511 | |
| WH Totals = | | \$16,990,000 | \$177,510,000 | \$670,000 | \$11,335,000 | \$10,415,000 | \$31,930,000 | \$34,070,000 | \$3,670,000 | \$3,380,000 | \$18,100,000 | \$18,100,000 | \$18,100,000 | \$8,700,000 | \$18,610,000 | \$22,800,000 | \$194,500,000 | \$2,065,759 | |
| Wolf Run | 1 | Wolf Run Main Trunk A | \$210,000 | \$1,990,000 | | \$210,000 | \$995,000 | \$995,000 | | | | | | | | | | \$2,200,000 | \$14,686 |
| | 2 | Wolf Run Main Trunk B | \$230,000 | \$2,180,000 | | | | \$230,000 | \$2,180,000 | | | | | | | | | \$2,410,000 | \$16,157 |
| | 3 | Wolf Run Main Trunk C | \$420,000 | \$4,140,000 | | | | | \$420,000 | \$2,070,000 | \$2,070,000 | | | | | | | \$4,560,000 | \$30,836 |
| | 4 | Wolf Run Main Trunk D | \$190,000 | \$1,730,000 | | | | | | | \$190,000 | \$1,730,000 | | | | | | \$1,920,000 | \$12,787 |
| | 5 | Wolf Run Main Trunk E | \$230,000 | \$2,140,000 | | | | | | | | \$230,000 | \$2,140,000 | | | | | \$2,370,000 | \$15,818 |
| | 6 | Wolf Run Main Trunk F | \$260,000 | \$2,460,000 | | | | | | | | | \$260,000 | \$2,460,000 | | | | \$2,720,000 | \$18,246 |
| | 7 | Wolf Run Main Trunk G | \$220,000 | \$1,990,000 | | | | | | | | | | | \$220,000 | \$1,990,000 | | \$2,210,000 | \$14,693 |
| | 8 | Wolf Run Equalization Tank | \$740,000 | \$7,940,000 | | \$740,000 | \$3,970,000 | \$3,970,000 | | | | | | | | | | \$8,680,000 | \$59,675 |
| | 9 | Parkers Mill Trunk | \$190,000 | \$1,770,000 | | | | | | | | | | | | \$190,000 | \$1,770,000 | \$1,960,000 | \$13,101 |
| | 10 | Bob O Link Trunk | \$190,000 | \$1,650,000 | | \$190,000 | \$1,650,000 | | | | | | | | | | | \$1,840,000 | \$12,137 |
| | 11 | Wolf Run Pump Station | \$- | \$9,500,000 | | | \$4,750,000 | \$4,750,000 | | | | | | | | | | \$9,500,000 | \$332,500 |
| WR Totals = | | \$2,880,000 | \$37,490,000 | \$5,890,000 | \$11,365,000 | \$4,965,000 | \$230,000 | \$2,600,000 | \$2,070,000 | \$2,260,000 | \$1,960,000 | \$2,400,000 | \$2,680,000 | \$2,180,000 | \$1,770,000 | \$40,370,000 | \$540,638 | | |
| Cane Run | 1 | Lower Cane Run EQ Tank | \$3,120,000 | \$33,440,000 | | | | | | | | | | | | | | \$36,560,000 | \$502,927 |
| | 2 | Expansion Area 3 PS | \$720,000 | \$6,980,000 | | | | | \$720,000 | \$3,490,000 | \$3,490,000 | | | \$8,360,000 | \$8,360,000 | | | \$7,700,000 | \$183,168 |
| | 3 | Expansion Area 3 FM | \$430,000 | \$3,370,000 | | | | | \$210,000 | \$220,000 | \$3,370,000 | | | | | | | \$3,800,000 | \$50,110 |
| | 4 | Expansion Area 3 Trunk | \$550,000 | \$4,840,000 | | | | | | \$550,000 | \$4,840,000 | | | | | | | \$5,390,000 | \$36,125 |
| | 5 | Shardon Park Trunks | \$260,000 | \$2,050,000 | | | | | | \$260,000 | \$2,050,000 | | | | | | | \$2,310,000 | \$15,179 |
| | 6 | Winburn Trunk | \$140,000 | \$980,000 | | | | | | | | \$140,000 | \$980,000 | | | | | \$1,120,000 | \$7,195 |
| | 7 | Thoroughbred Acres Trunk | \$170,000 | \$1,600,000 | | | | | | | | \$170,000 | \$1,600,000 | | | | | \$1,770,000 | \$11,798 |
| | 8 | Sharon Village PS and FM | \$220,000 | \$1,900,000 | | | | | | | | | \$220,000 | \$950,000 | \$950,000 | | | \$2,120,000 | \$52,253 |
| | 9 | Lower Griffin Gate Trunk | \$90,000 | \$770,000 | | | \$90,000 | \$770,000 | | | | | | | | | | \$860,000 | \$5,621 |
| | 10 | Upper Cane Run EQ Tank | \$500,000 | \$3,980,000 | | | | | | | | | \$500,000 | \$3,980,000 | | | | \$4,480,000 | \$29,701 |
| | 11 | Cane Run Trunk | \$180,000 | \$1,700,000</ | | | | | | | | | | | | | | | |

Table A-1. Disposition of Group Three Appendix A SSOs

| App. A No. | Location | Category | Sewershed | Disposition - SSO to be eliminated by: |
|------------|---------------------------------------|--------------|---------------|---|
| 1 | South Elkhorn, Bowmans Mill Rd. | Pump Station | South Elkhorn | SE 1 - Add Pump at South Elkhorn PS |
| 2 | North Elkhorn, Winchester Rd/I-75 | Pump Station | North Elkhorn | NE 1 - North Elkhorn EQ |
| 16 | Deep Springs, Anniston Dr. | Pump Station | North Elkhorn | <i>Eliminated by PS Replacement (April 2012)</i> |
| 17 | Dixie, Huntsville Dr | Pump Station | North Elkhorn | <i>Eliminated by PS Replacement (April 2012)</i> |
| 24 | Man o' War, Man o' War & Hamburg | Pump Station | North Elkhorn | NE 7 - Expansion Area 2A |
| 35 | 1914 Greenleaf Drive | Basement | North Elkhorn | <i>Maintenance related; Preventative Maintenance List</i> |
| 73 | Hisle Way, NE1_90 | Manhole | North Elkhorn | <i>Eliminated by Dixie Trunk Replacement in 2003</i> |
| 74 | Dartmoor Dr., NE1_199 | Manhole | North Elkhorn | NE 6 - Floyd Drive Area Rehab |
| 75 | Chatsworth Dr., NE1_84 | Manhole | North Elkhorn | <i>Eliminated by Dixie Trunk Replacement in 2003</i> |
| 76 | Chatsworth Dr., NE1_83 | Manhole | North Elkhorn | <i>Eliminated by Dixie Trunk Replacement in 2003</i> |
| 77 | Gayle Dr., NE1_25 | Manhole | North Elkhorn | <i>Eliminated by Dixie Trunk Replacement in 2003</i> |
| 85 | Mint Lane, Man o' War Bld @ Dunbar HS | Pump Station | South Elkhorn | SE 3 - Upgrade Mint Lane PS |
| 88 | Greenbriar 1, Antilles @ Golf Course | Pump Station | North Elkhorn | NE 7 - Expansion Area 2A |
| 89 | Greenbriar 2, Winchester Rd/Bahama | Pump Station | North Elkhorn | NE 4 - Greenbriar 2 PS Replacement |
| 91 | Hamburg Place Man o' War Blvd | Pump Station | North Elkhorn | NE 7 - Expansion Area 2A |
| 92 | Bluegrass Field, Bluegrass Airport | Pump Station | South Elkhorn | <i>Eliminated by PS Replacement in 2010</i> |
| 97 | Jingle Bell (1454), NE2_154 | Manhole | North Elkhorn | <i>Maintenance related; Preventative Maintenance List</i> |



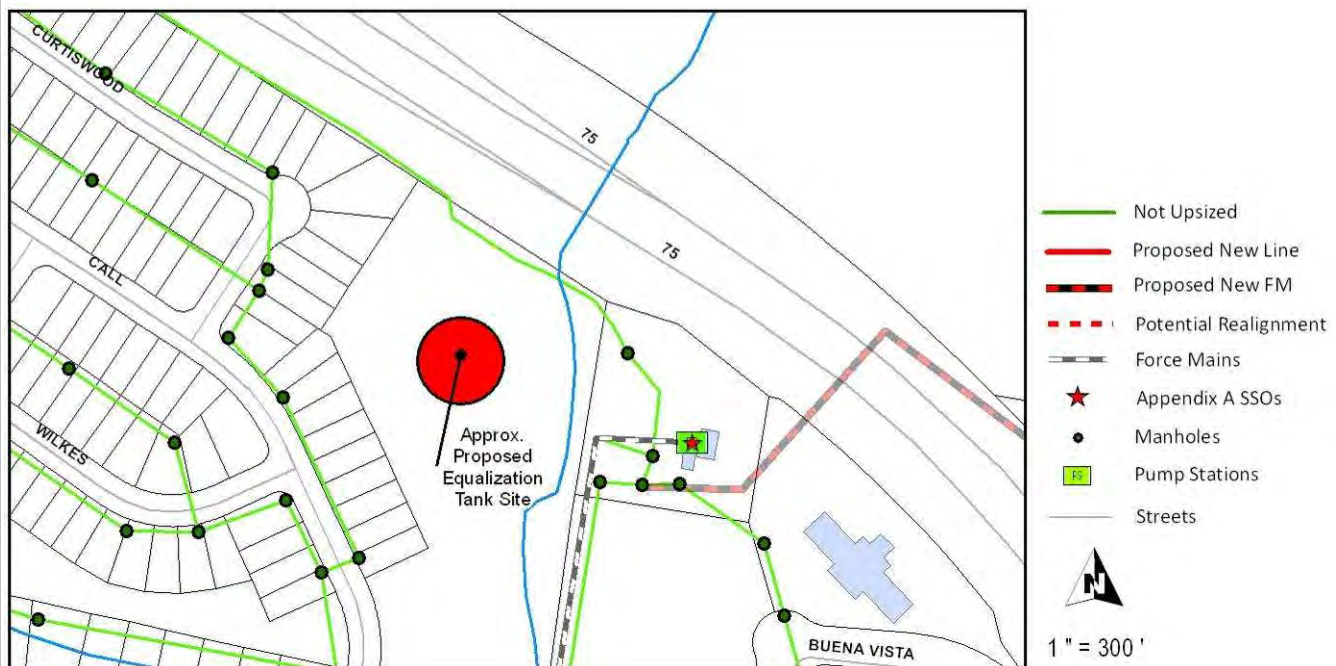
North Elkhorn Equalization Tank

| | | | |
|-----------------------------------|---|---------------------|-----|
| Watershed | North Elkhorn / Sub-basin NE1 | | |
| Project ID | G3-NE-1 | | |
| Project Type | EQ Tank | | |
| Project Quantities | 2.2 MG | | |
| Lower Manhole ID(s) | TBD | Upper Manhole ID(s) | TBD |
| Predecessor Projects | None | | |
| Preliminary Capital Cost Estimate | \$10,299,004 (includes design, easements, construction, administration) | | |
| Design Schedule | TBD | | |
| Construction Schedule | TBD | | |
| SSOs Eliminated by Project | PS_NE | | |

Notes

Construction of a 2.2 MG storage tank adjacent to the existing North Elkhorn Pump Station.

Location Map





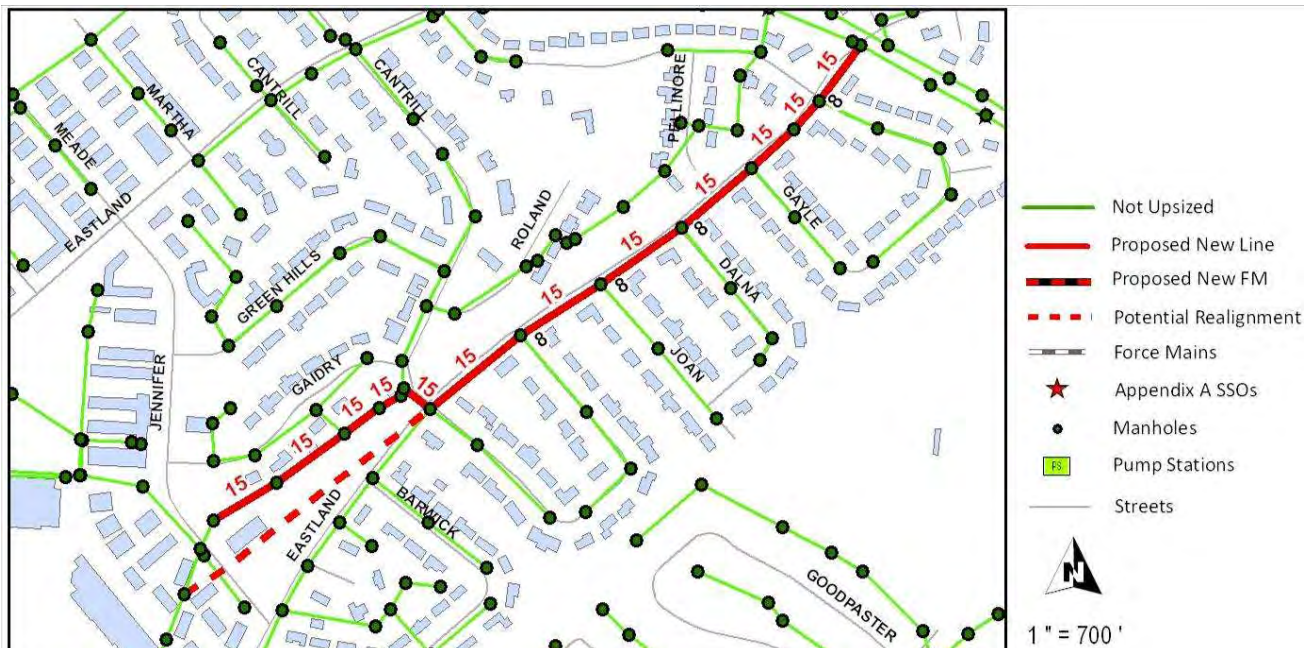
Eastland Trunk Sewer Replacement

| | | | |
|-----------------------------------|---|---------------------|-------|
| Watershed | North Elkhorn / Sub-basin NE1 & NE2 | | |
| Project ID | G3-NE-2 | | |
| Project Type | Sewer Trunk Upsizing | | |
| Project Quantities | Total Length: Approximately 3,095 linear feet (LF) 2,537 LF of upsizing to 15"; 558 LF of new 15". | | |
| Lower Manhole ID(s) | NE2_23 | Upper Manhole ID(s) | NE1_4 |
| Predecessor Projects | G3-NE-1 | | |
| Preliminary Capital Cost Estimate | \$1,487,295 (includes design, easements, construction, administration) | | |
| Design Schedule | TBD | | |
| Construction Schedule | TBD | | |
| SSOs Eliminated by Project | None – eliminates modeled SSO | | |

Notes

Additional relief sewer alignments are also being considered near the upstream end of the project and the preferred alignment will be determined during final design.

Location Map



*Red Numbers indicate new pipe diameter in inches; Black Numbers indicate existing pipe diameter in inches.

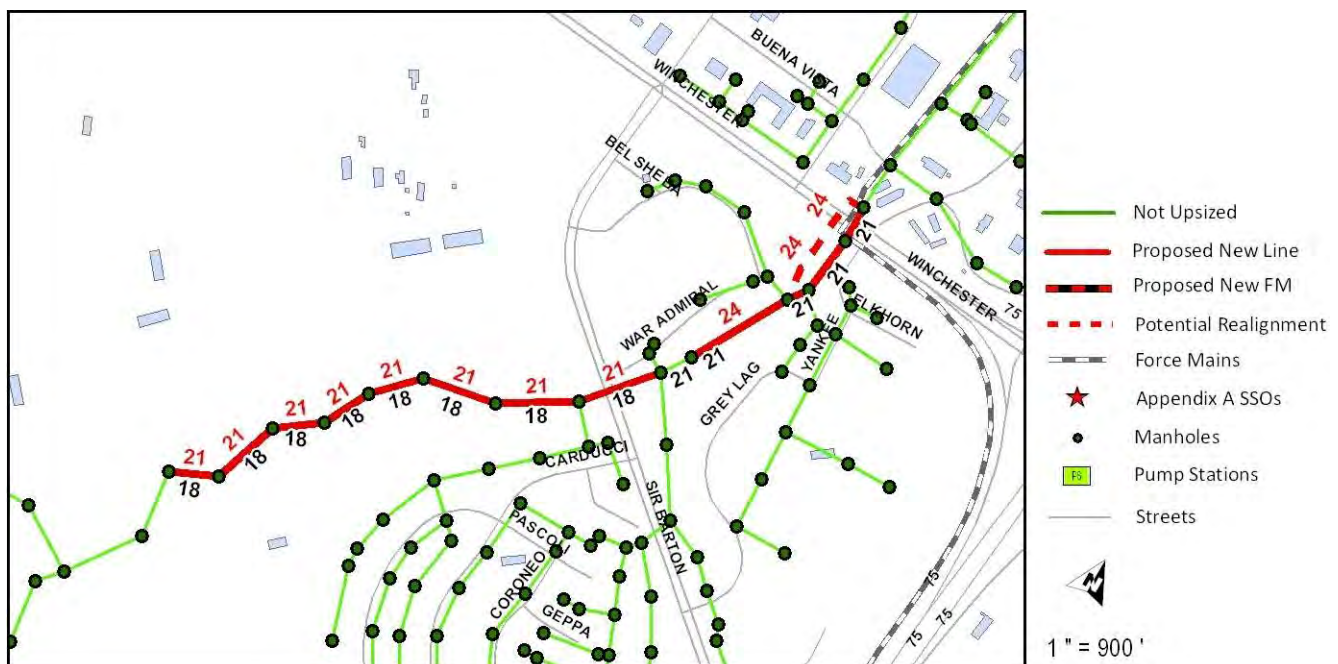


Liberty Road Trunk Sewer Replacement

| | | | |
|-----------------------------------|--|---------------------|--------|
| Watershed | North Elkhorn / Sub-basin NE1 & NE4 | | |
| Project ID | G3-NE-3 | | |
| Project Type | Sewer Trunk Upsizing | | |
| Project Quantities | Total Length: Approximately 3,583 linear feet (LF) 2,486 LF of 21"; 1,097 of 24". | | |
| Lower Manhole ID(s) | NE4_12 | Upper Manhole ID(s) | NE1_17 |
| Predecessor Projects | G3-NE-1 | | |
| Preliminary Capital Cost Estimate | \$3,023,252 (includes design, easements, construction, administration) | | |
| Design Schedule | TBD | | |
| Construction Schedule | TBD | | |
| SSOs Eliminated by Project | None – eliminates modeled SSO | | |

Notes

Location Map



*Red Numbers indicate new pipe diameter in inches; Black Numbers indicate existing pipe diameter in inches.



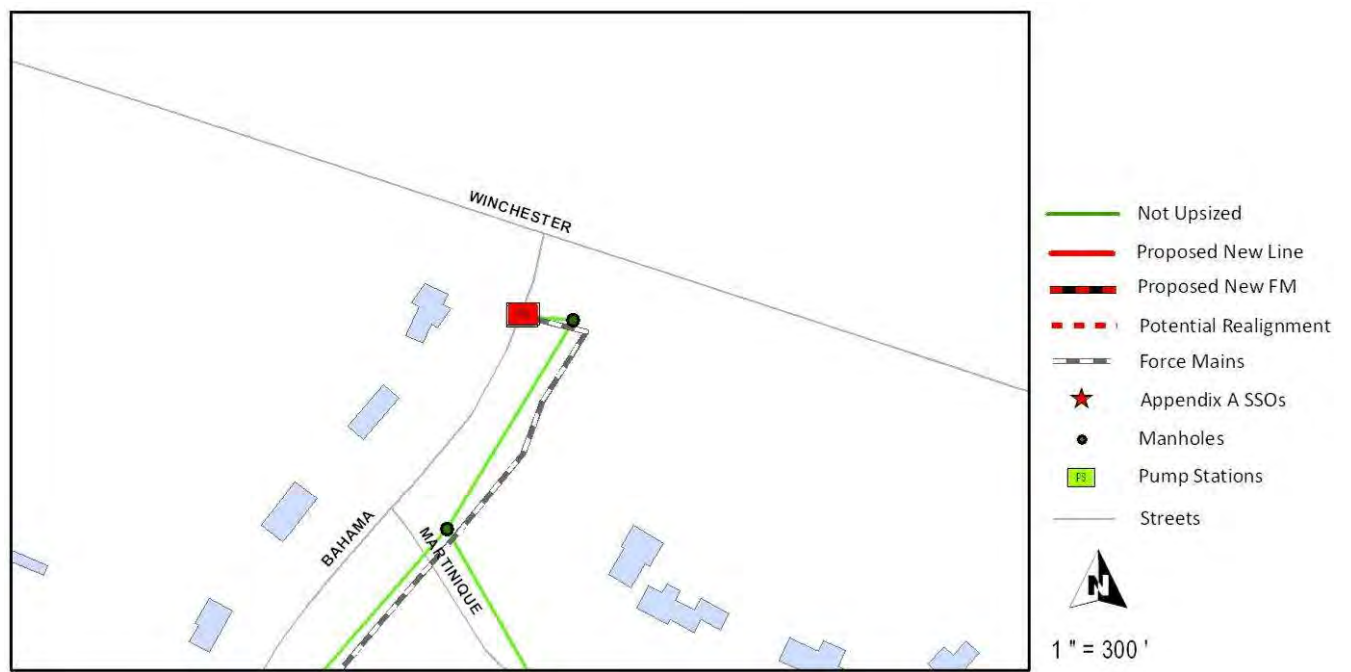
Greenbriar 2 Pump Station Replacement

| | | | |
|-----------------------------------|--|---------------------|-----|
| Watershed | North Elkhorn/ Sub-basin NE5 | | |
| Project ID | G3-NE-4 | | |
| Project Type | Construct New Pump Station | | |
| Project Quantities | 0.8 MGD pump station (560gpm) | | |
| Lower Manhole ID(s) | PS_GB2 | Upper Manhole ID(s) | N/A |
| Predecessor Projects | G3-NE-7 | | |
| Preliminary Capital Cost Estimate | \$1,155,764 (includes design, easements, construction, administration) | | |
| Design Schedule | TBD | | |
| Construction Schedule | TBD | | |
| SSOs Eliminated by Project | PS_GB2 | | |

Notes

The existing pump station is located in the median of Bahama Road at the intersection with Winchester Road; A new pump station site will be evaluated during design. Improvements to the force main are not anticipated, except for the extension and reconnection at the new pump station site.

Location Map



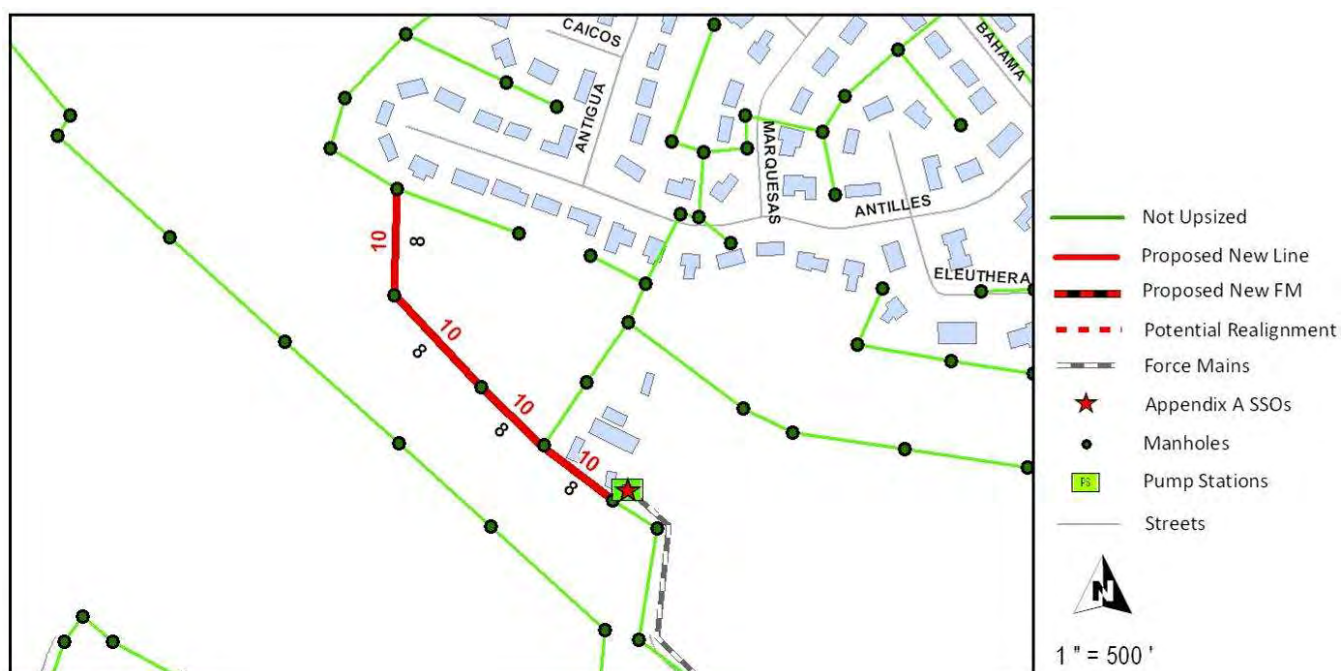


Greenbriar Trunk Sewer Replacement

| | | | |
|-----------------------------------|--|---------------------|--------|
| Watershed | North Elkhorn / Sub-basin NE5 | | |
| Project ID | G3-NE-5 | | |
| Project Type | Sewer Trunk Upsizing | | |
| Project Quantities | 1,050 linear feet of 10" | | |
| Lower Manhole ID(s) | NE5_9 | Upper Manhole ID(s) | NE5_77 |
| Predecessor Projects | G3-NE-7 | | |
| Preliminary Capital Cost Estimate | \$299,090 (includes design, easements, construction, administration) | | |
| Design Schedule | TBD | | |
| Construction Schedule | TBD | | |
| SSOs Eliminated by Project | None – eliminates modeled SSO | | |

Notes

Location Map



*Red Numbers indicate new pipe diameter in inches; Black Numbers indicate existing pipe diameter in inches.



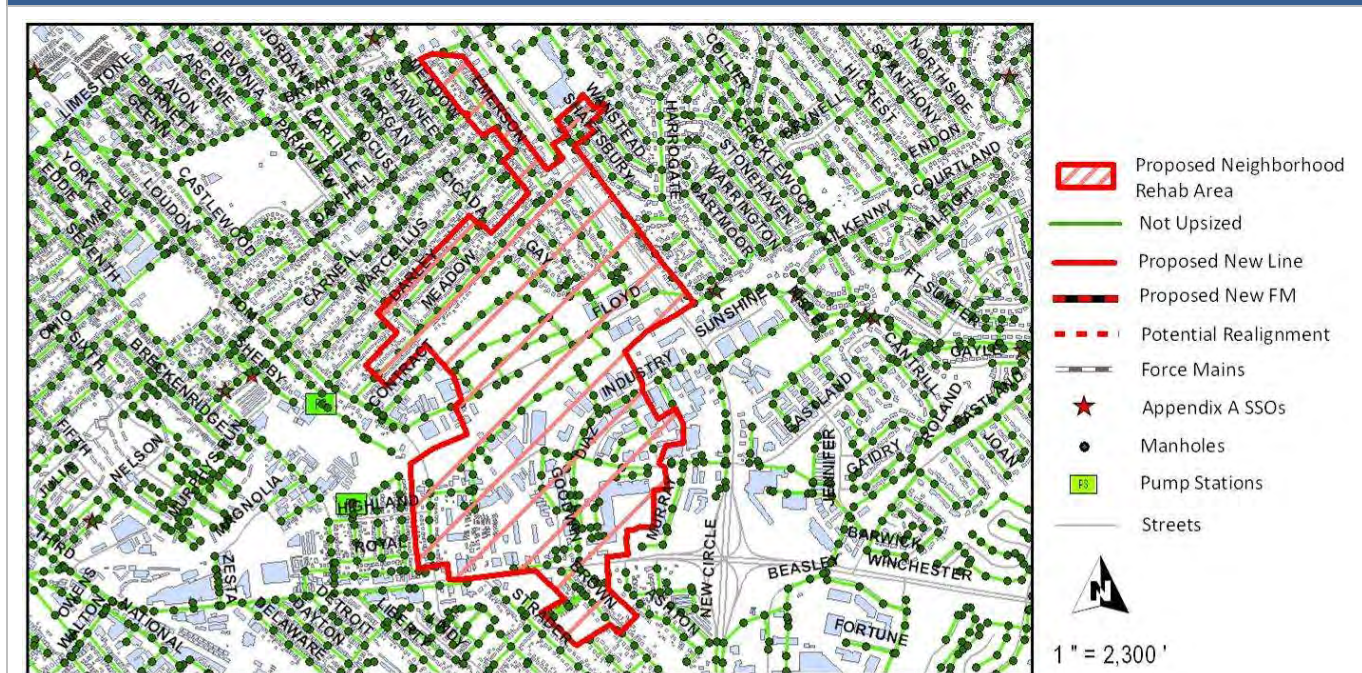
Floyd Drive Area Rehabilitation

| | | | |
|-----------------------------------|---|---------------------|-----|
| Watershed | North Elkhorn / Sub-basin NE1 | | |
| Project ID | G3-NE-6 | | |
| Project Type | Neighborhood Rehabilitation | | |
| Project Quantities | | | |
| Lower Manhole ID(s) | N/A | Upper Manhole ID(s) | N/A |
| Predecessor Projects | None | | |
| Preliminary Capital Cost Estimate | N/A – Completed through annual I/I budget | | |
| Design Schedule | TBD | | |
| Construction Schedule | TBD | | |
| SSOs Eliminated by Project | NE1_199 | | |

Notes

Rehabilitation and I/I removal in the wastewater collection system upstream of the Dixie trunk sewer in the Floyd Drive area. The project is included in the RMP but work will be performed by LFUCG as part of their annual rehabilitation/asset renewal program.

Location Map





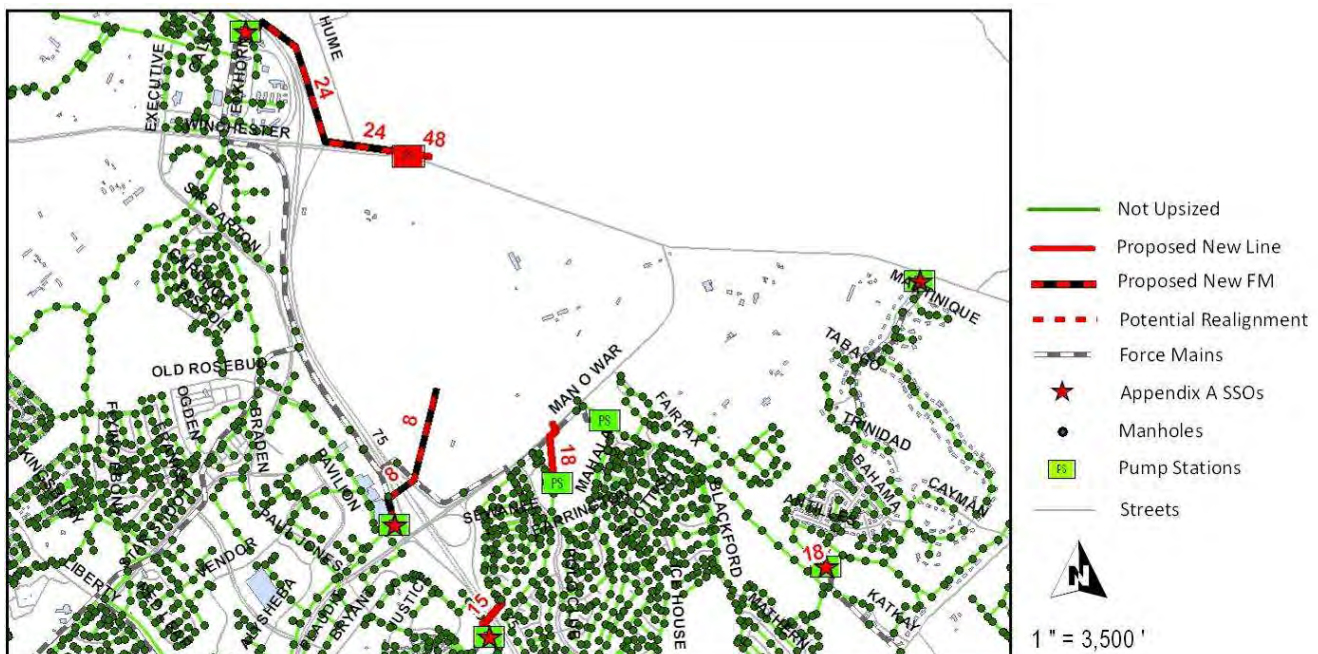
Expansion Area 2A Projects

| | | | |
|-----------------------------------|--|---------------------|-----|
| Watershed | North Elkhorn / Sub-basin NE4 & NE5 | | |
| Project ID | G3-NE-7 | | |
| Project Type | Construct New Force Mains and Gravity Sewers | | |
| Project Quantities | 11 MGD pump station and approximately 4,200 linear feet of 24" force main, short gravity sewers to eliminate 4 pump stations | | |
| Lower Manhole ID(s) | N/A | Upper Manhole ID(s) | N/A |
| Predecessor Projects | G3-NE-1 | | |
| Preliminary Capital Cost Estimate | N/A | | |
| Design Schedule | TBD | | |
| Construction Schedule | TBD | | |
| SSOs Eliminated by Project | PS_MOW, PS_HF, PS_GB1, PS_GB2 | | |

Notes

LFUCG is currently underway with projects to construct an 11 MGD pump station and approximately 4,200 linear feet of 24 inch force main discharging to the North Elkhorn Pump Station.

Location Map



*Red Numbers indicate new pipe diameter in inches.



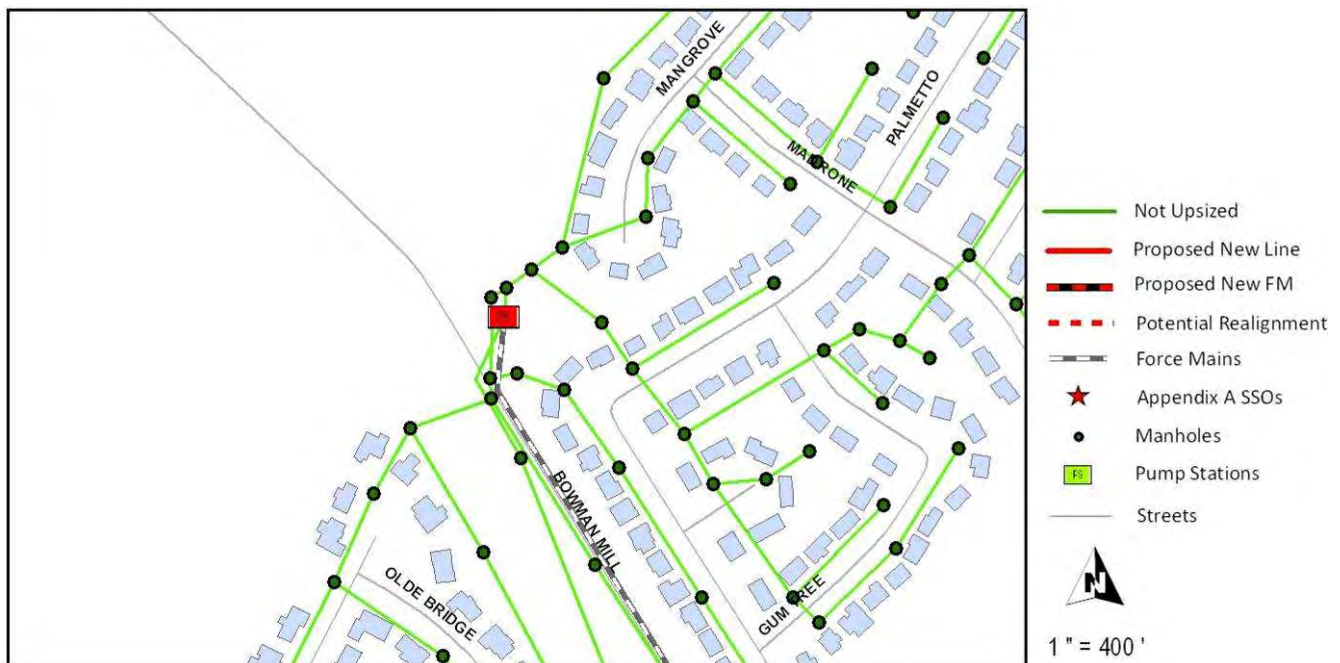
Add Pump at South Elkhorn PS

| | | | |
|-----------------------------------|--|---------------------|-----|
| Watershed | South Elkhorn / Sub-basin SE1 | | |
| Project ID | G3-SE-1 | | |
| Project Type | Addition of Pump at Pump Station | | |
| Project Quantities | Pump Addition and 4 MGD | | |
| Lower Manhole ID(s) | N/A | Upper Manhole ID(s) | N/A |
| Predecessor Projects | None | | |
| Preliminary Capital Cost Estimate | \$767,790 (includes design, easements, construction, administration) | | |
| Design Schedule | TBD | | |
| Construction Schedule | TBD | | |
| SSOs Eliminated by Project | PS_SE | | |

Notes

The RMP improvements include the addition of a sixth pump to bring the pump station capacity up to approximately 32 MGD from the existing operation of five pumps at 28 MGD. No improvements are anticipated to be necessary to the existing force main.

Location Map



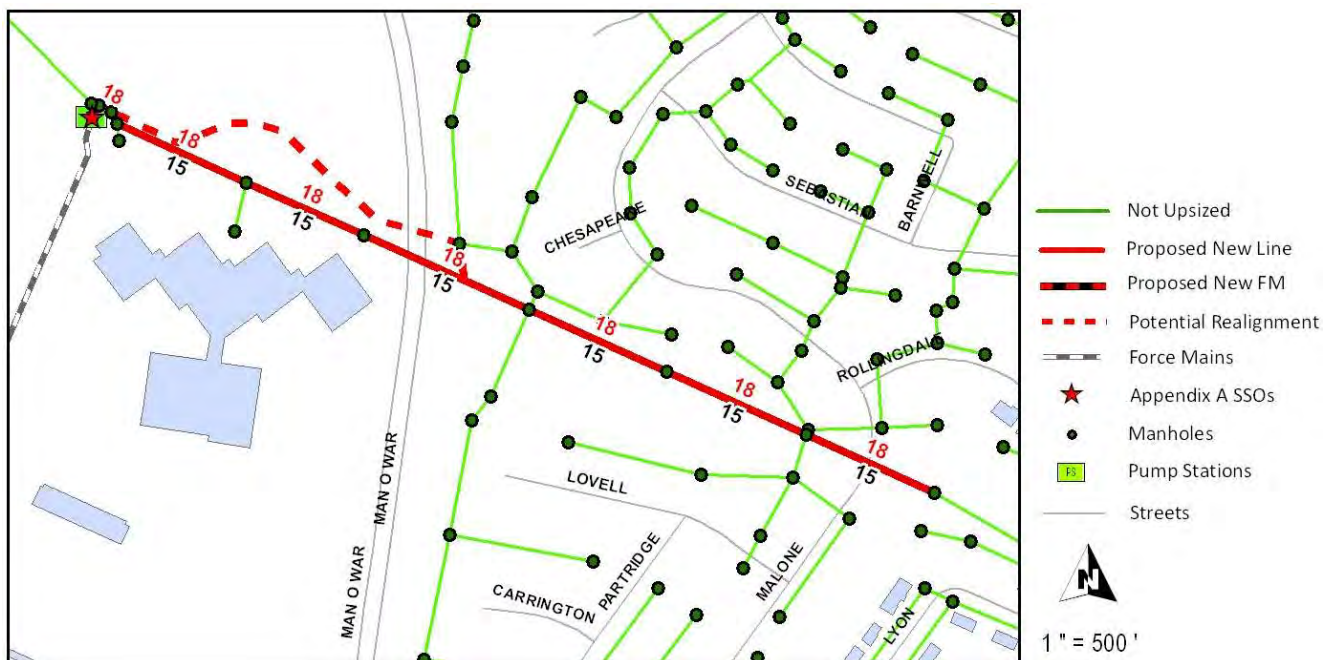


Mint Lane Trunk

| | | | |
|-----------------------------------|--|---------------------|----------|
| Watershed | South Elkhorn / Sub-basin SE3 | | |
| Project ID | G3-SE-2 | | |
| Project Type | Construct New Sewer Trunk | | |
| Project Quantities | 2,455 linear feet (LF) of pipe (18-inch) | | |
| Lower Manhole ID(s) | PS_ML | Upper Manhole ID(s) | SE3_6318 |
| Predecessor Projects | None | | |
| Preliminary Capital Cost Estimate | \$1,171,053 (includes design, easements, construction, administration) | | |
| Design Schedule | TBD | | |
| Construction Schedule | TBD | | |
| SSOs Eliminated by Project | None – eliminates modeled SSO | | |

Notes

Location Map



*Red Numbers indicate new pipe diameter in inches; Black Numbers indicate existing pipe diameter in inches.



Mint Lane Pump Station Upgrades

| | | | |
|-----------------------------------|--|---------------------|-----|
| Watershed | South Elkhorn / Sub-basin SE3 | | |
| Project ID | G3-SE-3 | | |
| Project Type | Pump Station Maintenance and Reliability Upgrades | | |
| Project Quantities | Upgrades to achieve approximately 4.6 MGD (3200gpm) | | |
| Lower Manhole ID(s) | PS_ML | Upper Manhole ID(s) | N/A |
| Predecessor Projects | None | | |
| Preliminary Capital Cost Estimate | \$4,415,899 (includes design, easements, construction, administration) | | |
| Design Schedule | TBD | | |
| Construction Schedule | TBD | | |
| SSOs Eliminated by Project | PS_ML | | |

Notes

The RMP improvements include pump replacement and/or maintenance upgrades to achieve a peak pump station capacity of approximately 4.6 MGD. No improvements are anticipated to be necessary to the existing force main.

Location Map

